WATER WORKS & SEWERAGE

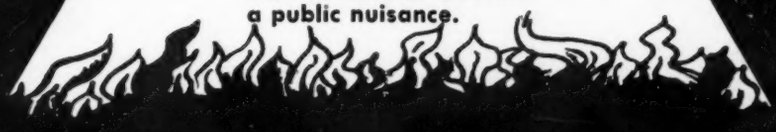
A GILLETTE ABP ABC PUBLICATION

Vol. 86, No. 11 NOVEMBER, 1939 L. H. Enslow Editor

Incineration Headquarters

INCINERATORS BUILT BY NICHOLS

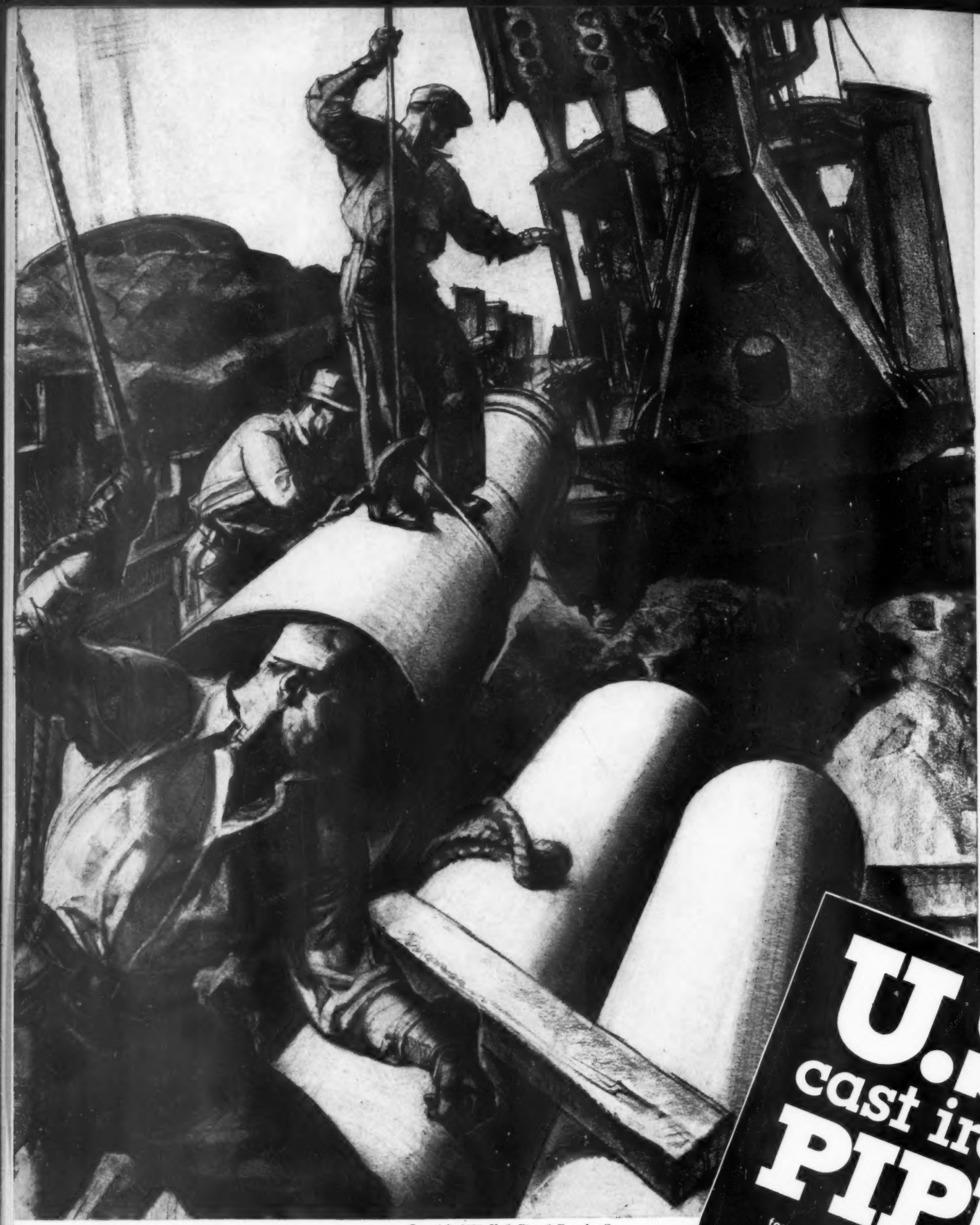
whether for burning sewage sludge, garbage, rubbish, or any combination of these, offer large or small communities a sanitary, efficient and economical method of reducing to harmless mineral ash all matter which might be dangerous to health or become a public nuisance.



NICHOLS

NERCO

60 WALL TOWER BLDG. NEW YORK, N. Y.



Copyright 1939, U. S. Pipe & Foundry Co.

Since 1922, when the first length of centrifugally cast gray iron pipe was commercially produced in this country by United States Pipe and Foundry Company, more than 100 million feet, or over 20,000 miles, have been shipped from our foundries. Today, U. S. Super-de Lavaud Pipe, centrifugally cast by an improved and patented *chill-free* process, has an unique metal structure, combining great strength with ductility and an extraordinary resistance to impact.

U.S. cast iron PIPE

for water works, gas, sewerage, drainage and industrial services.

U. S. PIPE & FOUNDRY CO.

General Offices, Burlington, N. J.

Plants and Sales Offices throughout the U. S. A.

"WITH NEATNESS AND DISPATCH . . "

¶ This dead front panel, installed in a New England city, provides control for two 15 H. P. Slip Ring Sewage Pump Motors, two 3 H. P. Vacuum Priming Pumps, and one ½ H. P. Ventilating Fan Motor, using a 2 phase, 4 wire system.

¶ The Sewage Pump Motors are Multi-Float Switch controlled—the speed control being arranged according to the level of Sewage. Switching arrangement is provided so that the operator may select either pump as the leading pump, and either pump may be manually operated at any one of three speeds.

¶ The Vacuum Pumps are operated by Vacuum Switches which may be interchanged with Vacuum Pump Starters to make either pump the leading unit. Manual starting is also provided.

¶ The Ventilating Fan Motor is operated manually for continuous duty, or by adjustable motor driven timer for automatic operation.

¶ Fused Safety type Main Line Disconnect Switches for each Motor are so interlocked that entrance to Fuse Compartment is impossible without throwing switch to "OFF" position.

¶ Lights indicate speed of either or both Sewage Pumps; Time Meters give a record of the total number of hours any pump has operated; and there's an Indicating Watt Meter for each Sewage Pump circuit, while a 6 pen, motor driven Recorder records the operation of each Pump at any speed.

¶ All apparatus is neatly mounted; concealed hinge doors of the flush type, when opened, offer easy access to all working parts.

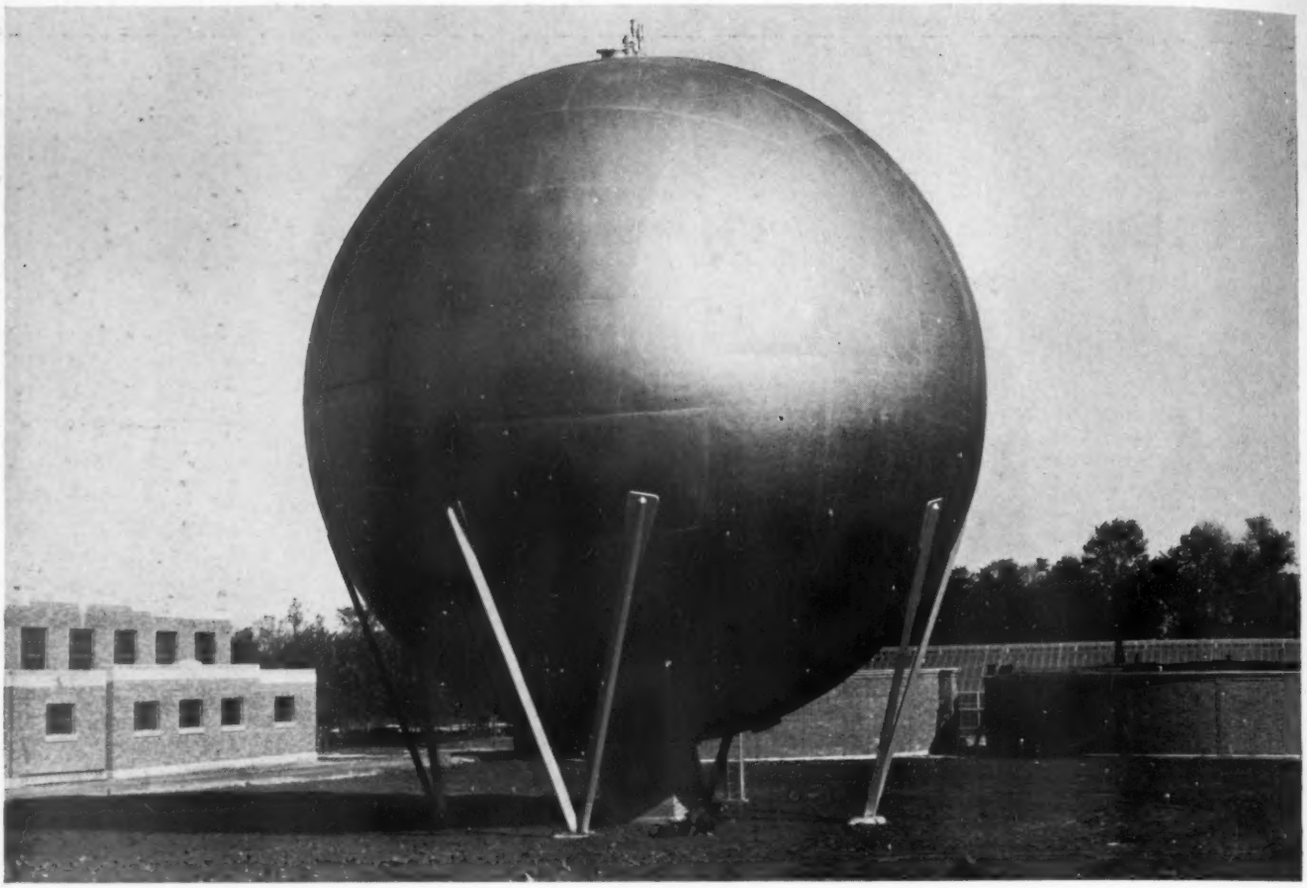
¶ There's a "3C" Control for every electric motor driven Pump. The benefit of "3C" engineering experience in Water Works and Sewage Pumping is at your service.

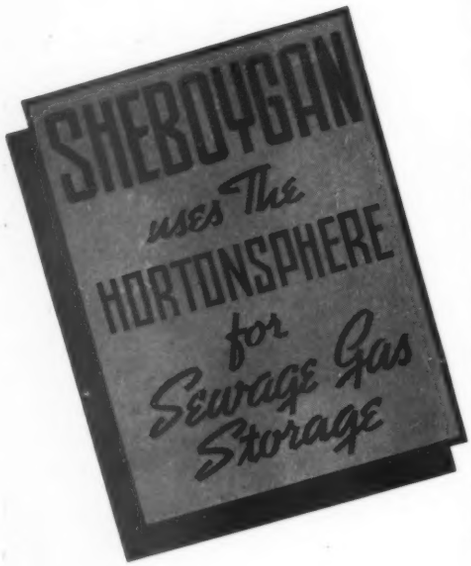
OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

WATER WORKS AND SEWERAGE, November, 1939. Volume 86. Number 11. Published monthly at 330 South Wells Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, United States and Canada, $2.00 per year; Foreign, $3.00 per year. Copyright, 1939. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under Act of March 3, 1879.





SHEBOYGAN, Wisconsin, is one of the increasing number of cities that are installing facilities at sewage treatment plants for utilizing the gas produced in the digestion process.

The 50 ft. dia. Hortonsphere illustrated above was installed at Sheboygan to insure a constant supply of gas, and to reduce operating costs. It is used to store a reserve supply of sewage gas under pressure up to a maximum of 40 lbs. per sq. in. The gas collected from the digesters flows directly to gas-burning engines, which generate power for pumping. Gas for heating purposes is also piped directly from the digesters. All surplus gas over that required for these operations is pumped into the Hortonsphere, to be used during low gas production periods. Water works engineers will recognize in this the same principle as is followed in using elevated water storage tanks to smooth out pumping rates.

The use of Hortonspheres for this type of service offers definite advantages. They are pleasing in appearance. The shell does not come in contact with the sewage, causing unsightliness and odor. With separate storage the solids in the digesters do not become permeated with gas, which interferes with the digestion process. For complete information about Hortonspheres for gas storage service, address our nearest office.

CHICAGO BRIDGE & IRON COMPANY

Chicago	2198 Old Colony Bldg.	Birmingham	1586 North 50th Street	Philadelphia	1644-1700 Walnut St. Bldg.
New York	3390-165 Broadway Bldg.	Tulsa	1646 Hunt Bldg.	Boston	1548 Consolidated Gas Bldg.
Cleveland	2262 Rockefeller Bldg.	Houston	2919 Main Street	San Francisco	1083 Rialto Bldg.
Dallas	1479 Liberty Bank Bldg.	Detroit	1551 Lafayette Bldg.	Los Angeles	1455 Wm. Fox Bldg.

Fabricating plants in CHICAGO, BIRMINGHAM, and GREENVILLE, PA.

The Truth About
LEAKAGE

Leakage from water mains is only one of the items that go to make up unaccounted-for water. Little exact information has been available as to how large or small this leakage item might be. However, experienced water works men know that, while unaccounted-for water will range from 10% to 25% in individual cases, the generally accepted average is 15% of normal consumption.

* * * *

To ascertain how much of the 15% average of unaccounted-for water is actually due to leakage from water mains, we have recently conducted a leakage test survey of cast iron mains in 25 cities in 6 states. The mains tested range from several hundred feet to more than twenty miles in length, in sizes from 4" to 30" and up to 44 years old, either with no service connections or relatively few that were turned off during the tests. The average leakage per mile of pipe, per inch of diameter, per 24 hours was 41 gallons—or an average of 380 gallons per mile of pipe per day for the sizes tested. This leakage is less than 2% of the average of normal consumption per mile of distribution main per day. This survey, covering a broad average of water main construction and substituting facts for guesswork, shows that

about nine-tenths of all unaccounted-for water* must be attributed to causes *other than leakage from cast iron water mains.

NORMAL CONSUMPTION OF WATER IS REPRESENTED BY 100% — 100%

UNACCOUNTED-FOR WATER AVERAGES 15% OF NORMAL CONSUMPTION — 15%

LEAKAGE FROM CAST IRON MAINS AVERAGED LESS THAN 2% OF TOTAL NORMAL CONSUMPTION — 2%

For further information write to THE CAST IRON PIPE RESEARCH ASSOCIATION, Thomas F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

CAST-Q IRON

Look for the "Q-Check" registered trade mark. Cast iron pipe is made in diameters from 1¼ to 84 inches.

MATHIESON SANITATION SERVICE *Proves its worth* TO MODERN WILMETTE, ILLINOIS

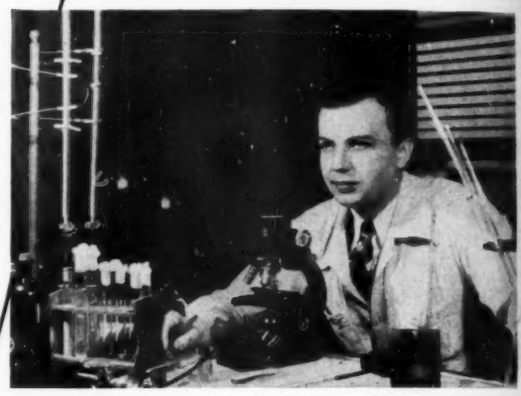
. . . Says Gerard S. Noerenberg, Chemist, Wilmette Filtration Plant

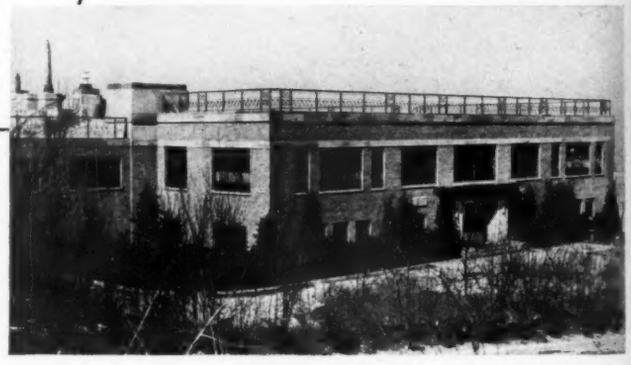
"We have been users of your Chlorine for about nine years with an intermediate gap when we used another source of supply. This experience (sticky valves) fully confirmed our belief that Mathieson service is both dependable and advantageous to us. Your product has been uniformly good. There has been no trouble with sticky valves.

"We also use HTH in its convenient packaged form, in a number of ways. It is used as a stand-by emergency source of Chlorine in our Filtration Plant, to sterilize all new mains and reservoirs and as a health help in the prevention of Athlete's Foot in the Waterworks locker room. The public bathing beach has been using HTH for years in the showers and locker rooms. In the outlying districts, HTH is used in the sterilization of wells.

"Not the least of advantages in using your products has been the friendly, constant and able assistance given us by your representative, who stops in on us frequently."

Gerard S. Noerenberg, Chemist, Wilmette Filtration Plant.





Lake Michigan Filtration Plant, Wilmette, Illinois.

● Whether the job in hand be water purification, sewage treatment or swimming pool sanitation, you have a right to expect a dependable supply of liquid chlorine—a pure product, trouble-free containers and valves, prompt delivery service. It is because Mathieson Chlorine has proved itself in these three essentials that so many communities like Wilmette, Illinois specify "Mathieson" when there is a chlorinating job to be done.

Mathieson Chlorine, coupled with HTH for special and emergency jobs that so often arise, make a team hard to beat for dependable sanitation service.

HTH comes in 5-lb. cans with replaceable caps, packed 9 cans to the case; also in 75-lb. drums.

THE Mathieson Alkali Works (INC)

60 EAST 42ND STREET, NEW YORK, N. Y.

LIQUID CHLORINE . . . HTH . . . SODA ASH . . . CAUSTIC SODA . . . BLEACHING POWDER . . . BICARBONATE OF SODA . . . AMMONIA, ANHYDROUS and AQUA . . . PH-PLUS FUSED ALKALIS . . . DRY ICE . . . CARBONIC GAS

YEARS OF DEPENDABILITY

4 POINT CONTACT GATE VALVE

AN UNDUPLICATED COMBINATION OF FEATURES

1. No Binding of Stem
2. Non-Rusting Packing Bolts and Nuts
3. Easy to Re-pack
4. No Scraping of Discs on Seats
5. Pressure Equally Distributed on Discs and Seat Rings
6. No Leakage
7. No Sprung Discs
8. No Incrustations
9. Gate Assembly Can't Fall Apart
10. No Side Strains on Stem

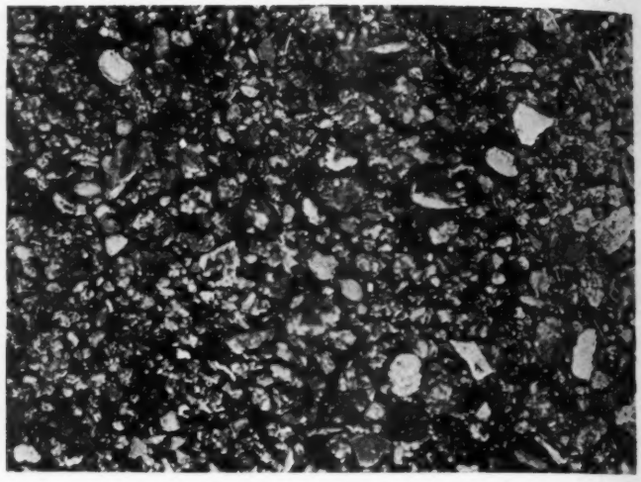
Be sure you have complete information on Mueller-Columbian Gate Valves before you specify. Detailed information and illustrations are ready for you for the asking.

MUELLER CO.

CHATTANOOGA TENNESSEE

NO ODOR From Pictures
BUT THEY DO TELL A STORY...

The illustration above shows an actual sample (magnified about four times) of unwashed sewage grit . . . taken during a test. Notice the seeds, sticks and other organic solids. Also note the adherence of the particles.



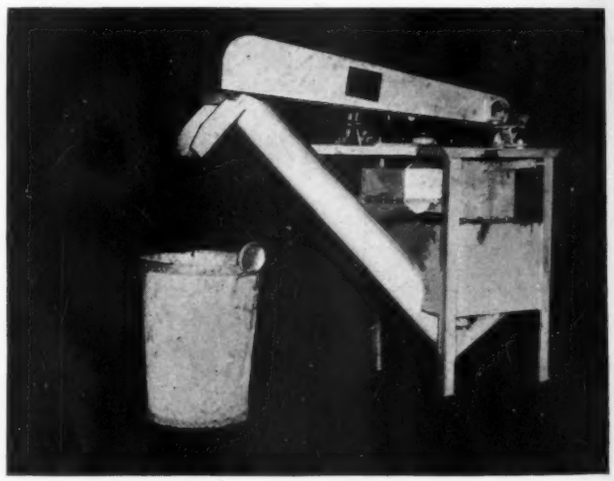
An actual sample of the washed grit (also magnified about four times), is shown above. Note the clearness of each particle and the absence of coarse organic material.

Process and apparatus patented.

Jeffrey JIGRIT No. 1—capacity one ton of feed per hour.

Jeffrey JIGRIT No. 4—capacity four tons of feed per hour. Automatic control of operation.

JEFFREY JIGRIT process can produce results . . . 80 to 90% removal of putrescible solids and larger organic solids not generally classed as such . . . a clean grit suitable for fill or walkways about the plant.

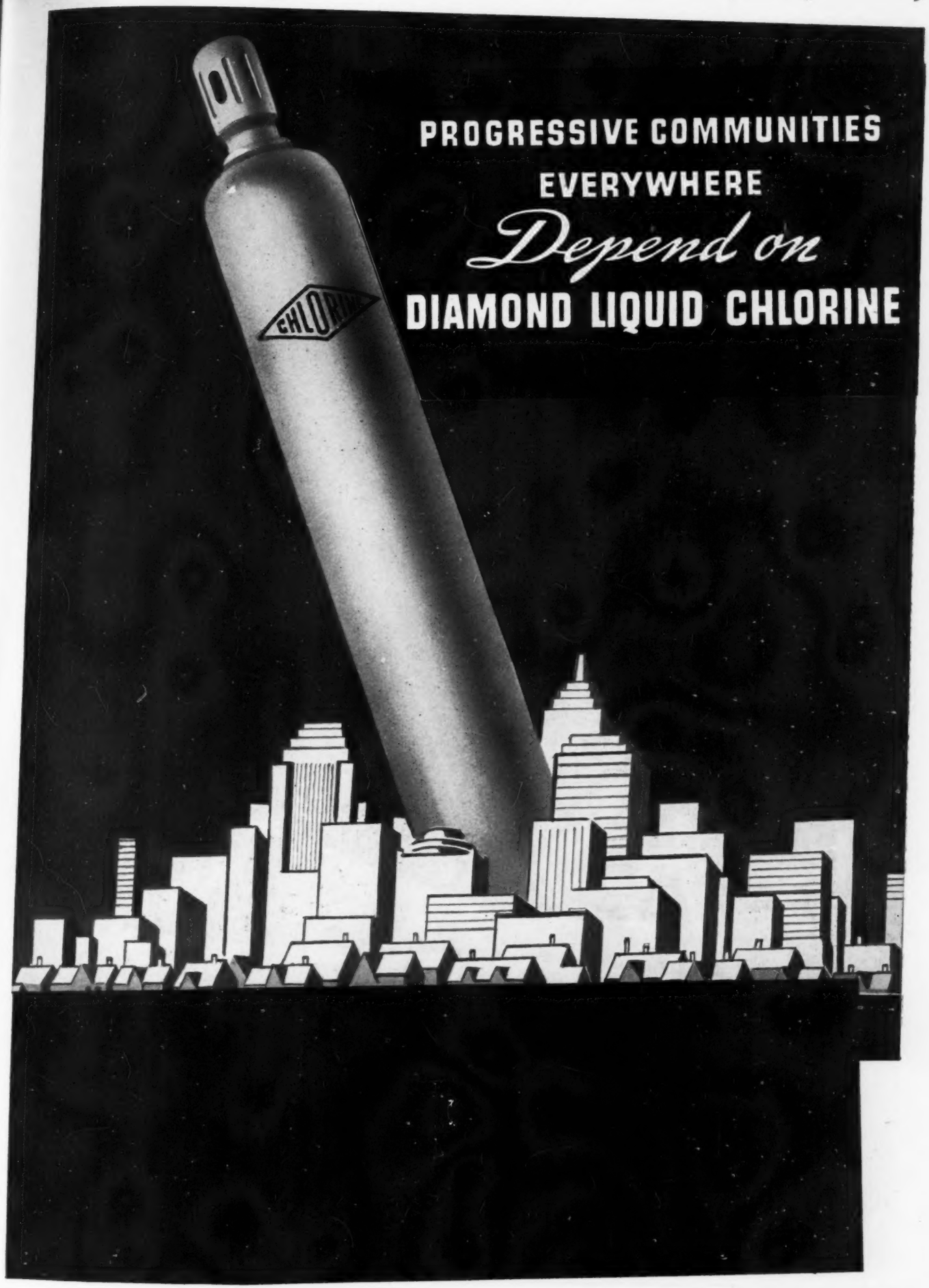


This Jeffrey JIGRIT process has been 'dubbed' a "member of the Mutual Scrubbing Society" because it really does scrub the grit, freeing adhering organic solids . . . and it classifies the products, rejecting with the overflow organic solids that make appearance unsightly.

Send for Descriptive Literature

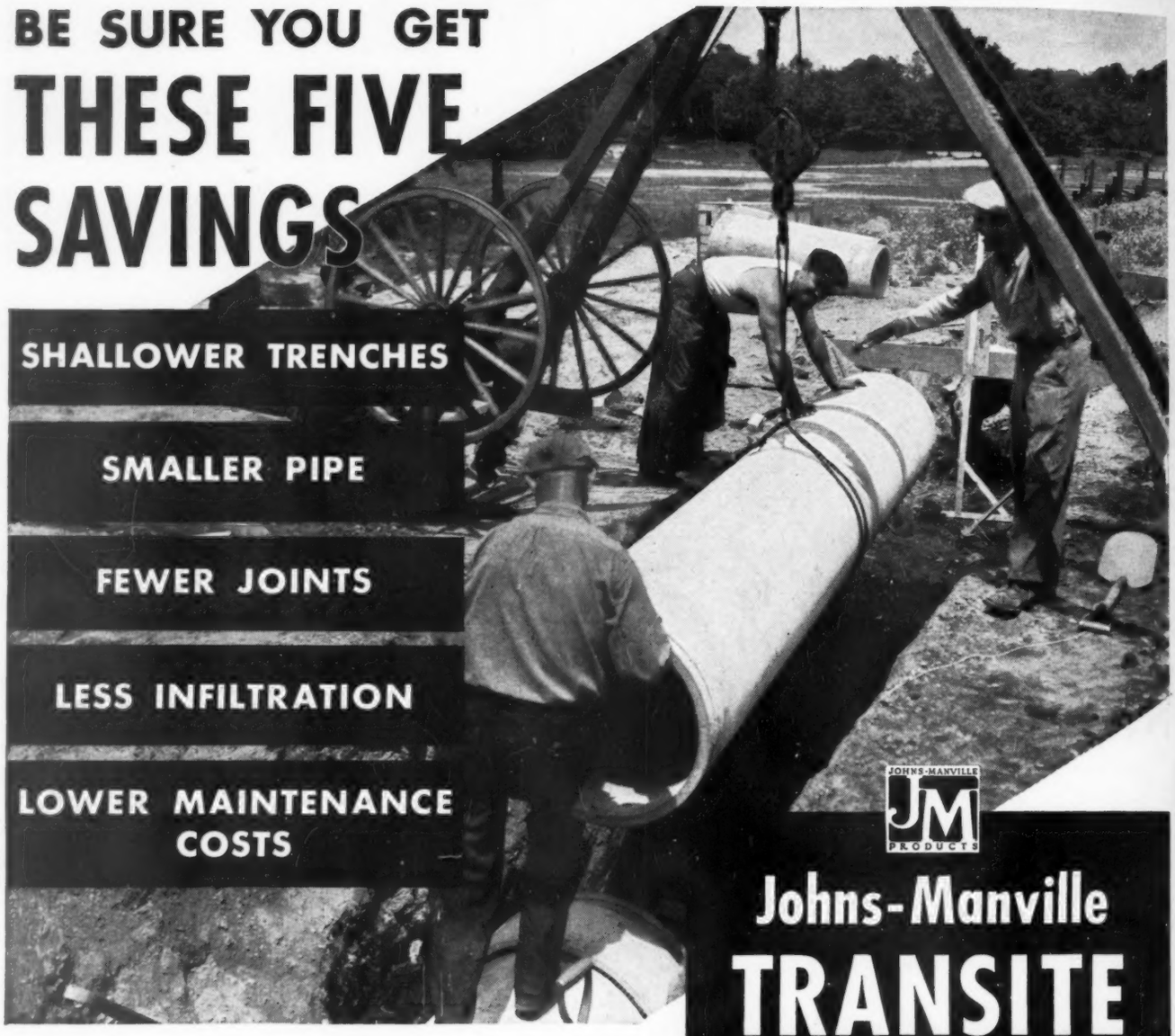
The Jeffrey Manufacturing Company

996-99 North Fourth St. COLUMBUS, OHIO


PROGRESSIVE COMMUNITIES
EVERYWHERE
Depend on
DIAMOND LIQUID CHLORINE
CHLORINE

ON YOUR NEXT SEWER LINE

BE SURE YOU GET THESE FIVE SAVINGS



- SHALLOWER TRENCHES
- SMALLER PIPE
- FEWER JOINTS
- LESS INFILTRATION
- LOWER MAINTENANCE COSTS

JOHNS-MANVILLE JM PRODUCTS

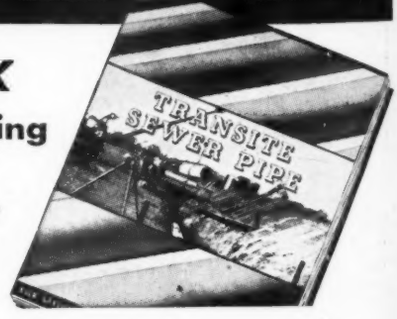
Johns-Manville TRANSITE PIPE

The MODERN Material for Sewer and Water Lines

IN ALL TYPES of municipal sewer systems, J-M Transite Sewer Pipe provides important savings on the above five points. Asbestos-cement in composition, this durable pipe comes in long, easily installed lengths that reduce the number of joints in the line. Its unusual corrosion-resistance keeps maintenance low. Joints stay tight. And in many cases, because of Transite's unusually high carrying capacity, grades can be flatter, trenches shallower, or smaller pipe may be used.

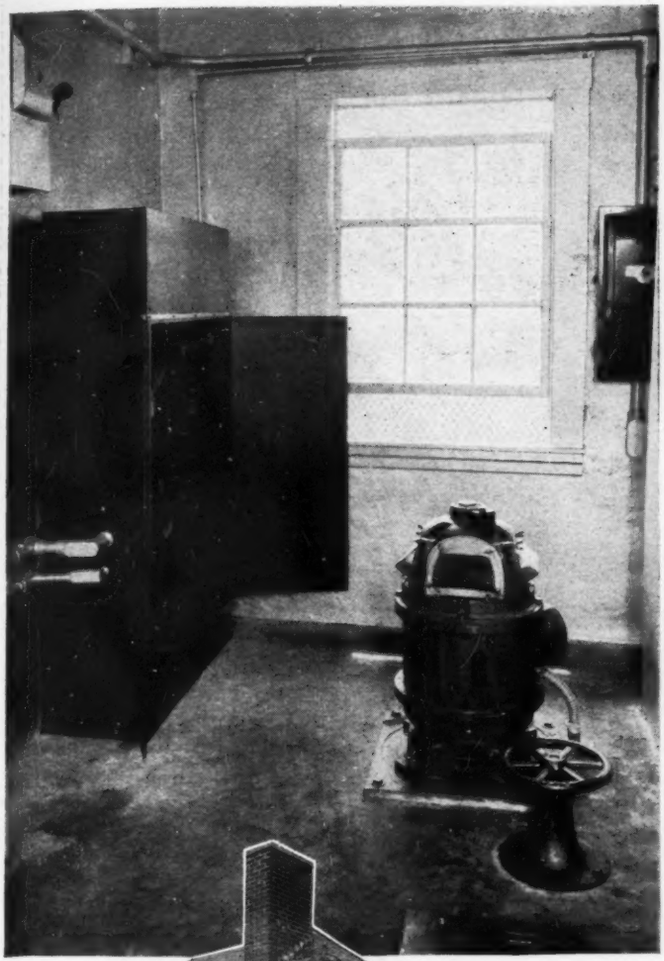
For details, send for Transite Sewer Pipe brochure TR-21A. And, if you are interested in low-cost water transportation, get the TransiteWater Pipe brochure TR-11A. Johns-Manville, 22 East 40th St., New York, N.Y.

FREE BOOK
gives convincing facts...Write for your copy



CONTROL METHOD

SAVES $553



Westinghouse "synchro-tie unit" at Rockdale Pumping Station provides closer speed regulation, smoother acceleration, lower maintenance . . . at 60% the cost of the installation originally considered.

The 500 gpm Rockdale station at Northbridge, Mass., had a problem of controlling two 10 hp wound rotor motor-driven pumps automatically to give variable speed operation and maintain a constant water level.

Westinghouse recommended a control scheme using a synchro-tie mechanism to transmit float level indications to the pumping units. Result — 40% saved in initial cost over the method previously considered, and smoother, more foolproof operation.

Thus is proved the value of dealing with an organization with specialized knowledge — indicated by the use of Westinghouse equipment in waterworks and sewage disposal plants in 64% of the larger cities of The United States. You'll save time, money, and obtain better results, when you consult Westinghouse. See our local office, or write Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

J-94137

Westinghouse

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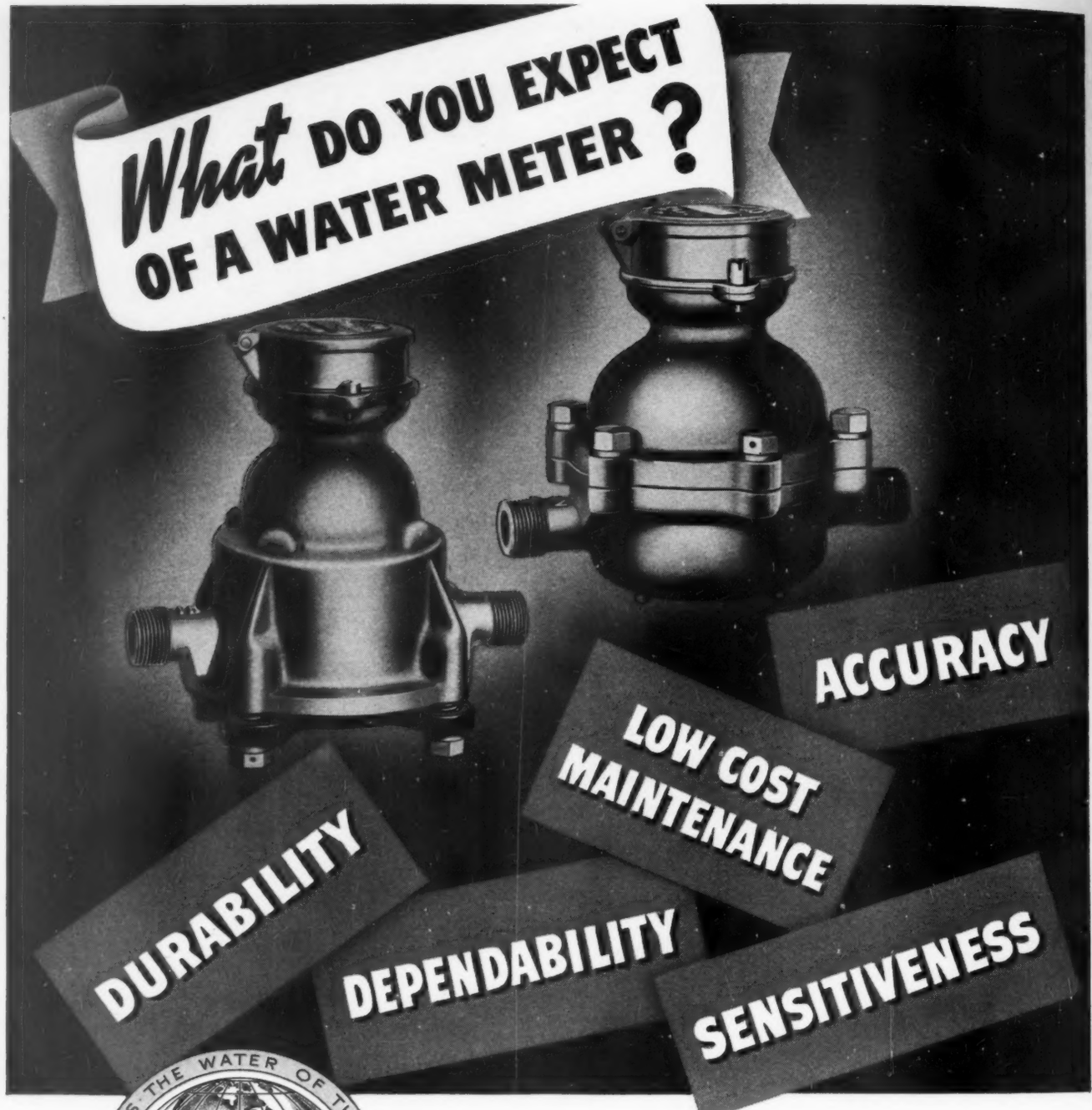
W WESTINGHOUSE ELECTRIC



MEASURES THE WATER OF THE WORLD
BADGER

BADGER METERS PROVIDE ALL OF THESE VALUES . . .
IN FULL MEASURE

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MILWAUKEE, WISCONSIN

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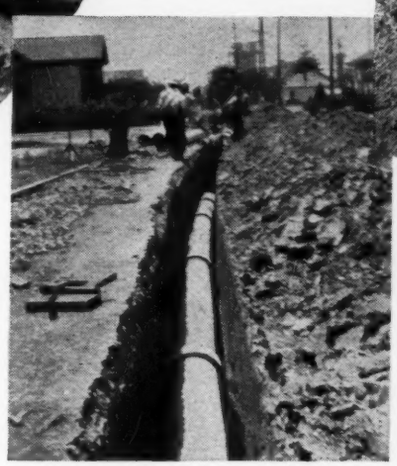
BADGER *Water* **METERS**

4th FEATURE OF AN EFFICIENT, LOW-COST WATER SYSTEM } SUSTAINED HIGH CARRYING CAPACITY

(*Left*) **SMOOTH INTERIOR OF J-M TRANSITE** gives higher delivery capacity with smaller pipe. Pumping costs are unusually low right at the start. And they *stay* low, for Transite is entirely nonmetallic, cannot tuberculate under any condition.

(*Below*) **ASBESTOS-CEMENT** in composition, Transite Pipe is strong and durable, completely immune to electrolysis. Its exceptional resistance to soil corrosion keeps maintenance permanently low.



(*Above*) **LOW INSTALLATION COSTS** are a feature of Transite Pipe lines. Supplied in long, light lengths, this modern material is easy and economical to handle. Simplex Couplings are quickly assembled . . . form tight joints that minimize costly water loss.

BECAUSE of the smooth surface of the polished steel mandrel on which it is made, J-M Transite Pressure Pipe has an unusually smooth interior surface. Its initial flow coefficient is C=140. As a result, carrying capacity is exceptionally high . . . pumping costs stay low.

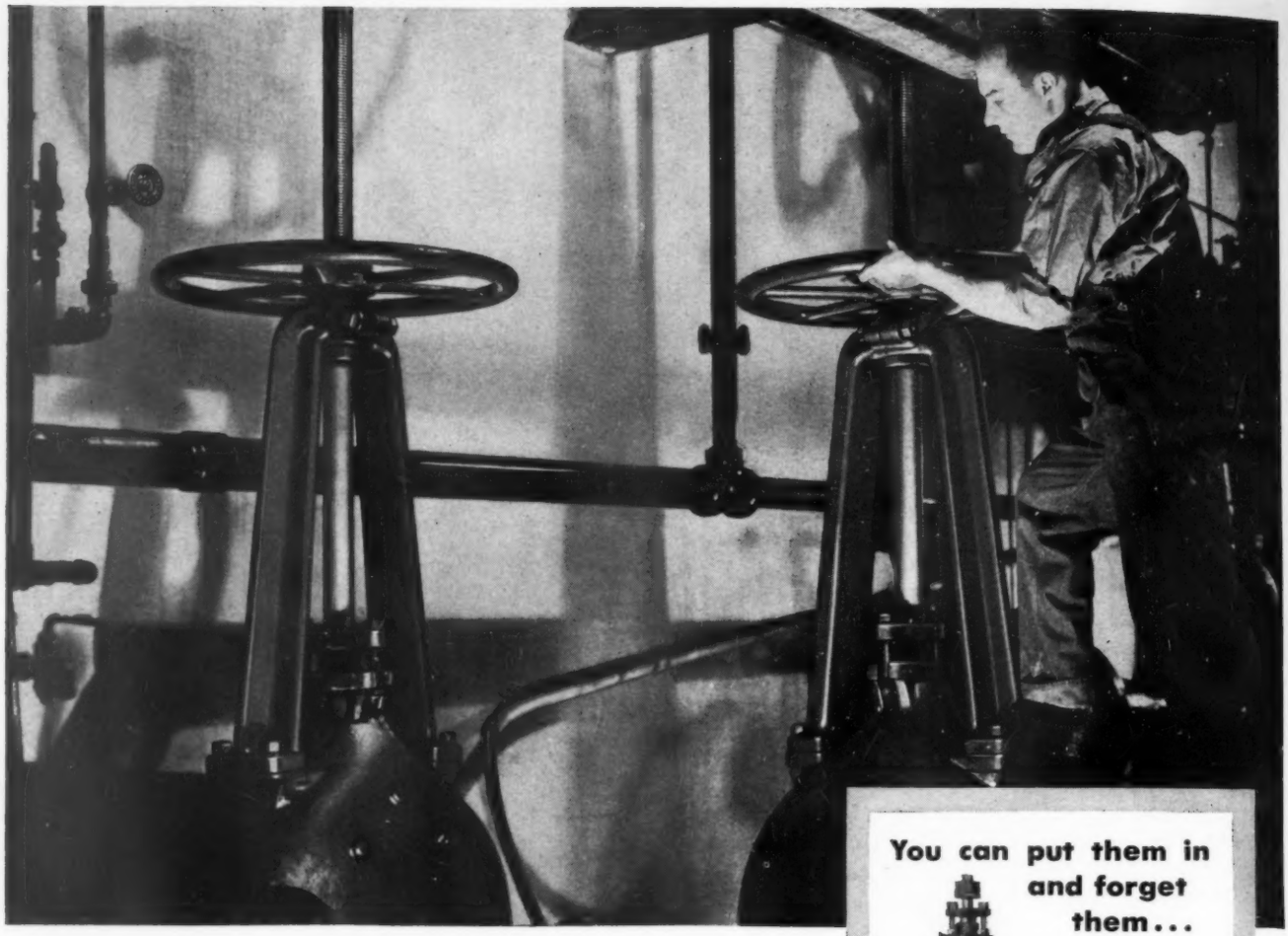
In service, Transite makes many other important savings. Asbestos-cement in composition, its high carrying capacity can never be reduced by tuberculation. Tight, easily assembled Simplex Couplings virtually eliminate joint leakage. And, because J-M Transite Pipe is entirely inorganic and non-metallic, it offers exceptional resistance to all forms of soil corrosion. Maintenance is negligible throughout the system's long life.

Furthermore, Transite's light weight, long lengths and simple assembly make installation easy and economical. For details on its 25-year service record, send for Transite Water Pipe brochure TR-11A. And if sewage disposal is your problem, get Transite Sewer Pipe brochure TR-21A. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM PRODUCTS

Johns-Manville TRANSITE PIPE AN ASBESTOS PRODUCT

THE MODERN MATERIAL FOR WATER AND SEWER LINES



Peace of Mind
AT THE WATER WORKS

DAY to day operations in water works are pretty much a routine—but, emergency always threatens. And when it strikes, it's met with valves. What a peace of mind to the superintendent, to the engineer, and to the municipality's management to know that their plant is equipped with valves that will not fail at an urgent moment.

Such valves are Crane Valves—because they're engineered for water works service. Infrequent operation, for example, does not hinder Crane Valve performance. Crane design provides for such service. With adequate resistance to mechanical strains and corrosive effects, both inside and out, Crane Valves assure unfailing response when shut off or diversion of flow is necessary.

There's peace of mind, too, in knowing that excessive valve repairs and replacement costs are eliminated when you Crane-Equip. That experience of more than 84 years, elaborate metallurgical research, and extreme accuracy in manufacturing stand back of the valves in your plant.

For peace of mind in any flow-control problem requiring large or small equipment—in pumping stations, filtration plants, or sewage systems—turn to your Crane No. 52 Catalog. Among its 38,000 items you'll find exactly the one you need.

You can put them in and forget them... CRANE A.W.W.A. VALVES

... And when it is necessary to shut off the main or distribution lines, you don't have to worry about valve troubles. As you turn the stem on these Crane 480½'s they'll respond—smoothly and surely.

Crane No. 480½ double disc gate valves comply with A. W. W. A. standards. But in service in your lines, it's their Crane-Quality that counts. It's Crane laboratory control of raw materials that gives bodies added strength to cope with stresses and strains—that gives seats and discs greater resistance to corrosion. It's Crane engineering in every part that assures you enduring dependability at minimum maintenance cost.

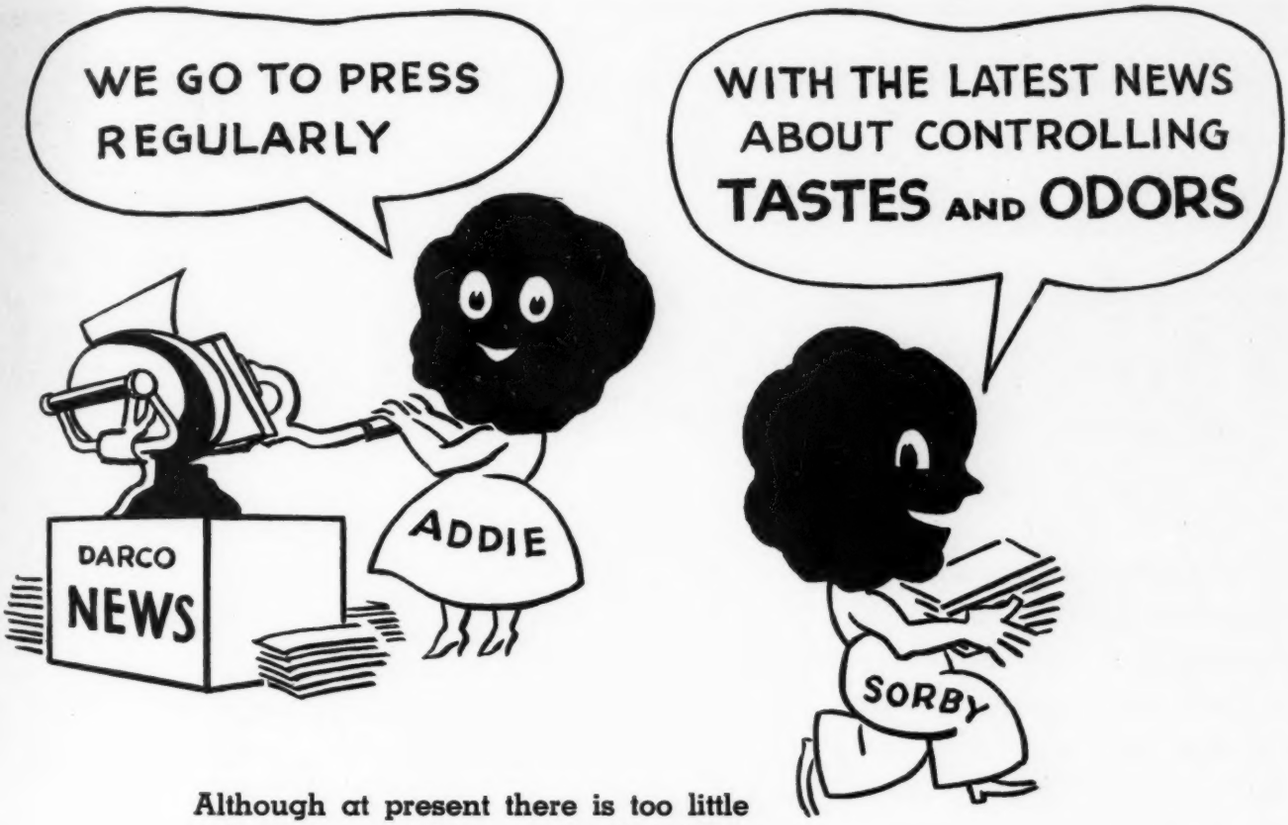
You can safely build for the future with Crane 480½ valves in your distributing system. Ask your Crane Representative to demonstrate why.

CRANE

CRANE CO., GENERAL OFFICES
836 S. MICHIGAN AVE., CHICAGO

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS



Although at present there is too little information on taste and odor tests, research is constantly developing more accurate methods of measurements—measurements that are indispensable to water works men in doing an effective job of palatability control.

Through Darco News, Darco gives water works people an authentic story of the progress of research — putting the material discovered in such shape that it can be readily used. With the information already published in Darco News, you can evaluate carbon performance with sufficient accuracy to pick the best carbon for your plant. You can also evaluate the effectiveness of different methods of application.

Both the Darcograph and the Carbon Feed Chart prove that HYDRODARCO* gives best palatability control per dollar.

*Reg. U. S. Pat. Off.

DARCO

DARCO CORPORATION

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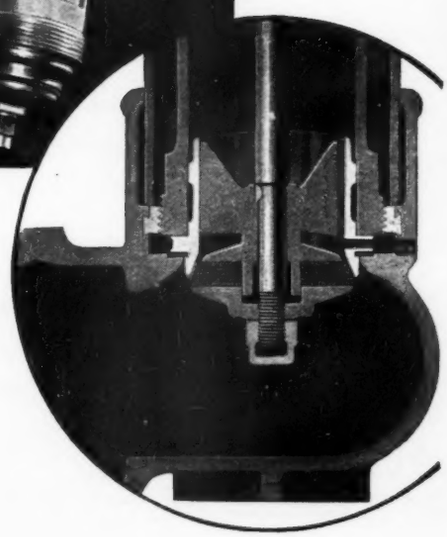
This removable feature makes

Mathews Hydrants Frostproof

It means much to your city that all operating parts of a Mathews Hydrant are contained in the barrel which slides down through the protection case and screws into the elbow. Not only does it provide a quick-change method which lets you use spare barrels to repair traffic damage or make general overhauls quickly—but in winter it provides active prevention of frost damage. The hydrant barrel, containing all working parts, screws tight into the elbow, but the protection case rests loose, free to rise as ground freezes around it and swells. With no force exerted on water-carrying parts, thrusting frozen ground can not crack castings or loosen joints. Specify Mathews and enjoy this advantage, for winter and frost are the most serious threats to fire protection.



MATHEWS HYDRANTS

***Made by* R. D. WOOD COMPANY**

Manufacturers of Sand Spun Pipe (centrifugally cast in sand molds) and R. D. Wood heavy-duty gate valves for water works

400 CHESTNUT STREET, PHILADELPHIA, PA.

More than 50 miles of concrete pipe sanitary sewers and 25 miles of concrete pipe storm sewers have been installed in Jackson, Miss., since 1926. Recent inspection of sewers in service 12 years has shown the pipe to be in excellent condition. J. J. Halbert, City Engineer; E. R. Dickerson, Assistant City Engineer.

CONCRETE PIPE SEWERS

when properly designed and constructed, minimize leakage and infiltration

SINCE 1926, city engineers of Jackson, Mississippi, have been extending and modernizing their sewerage system. And, as in scores of America's most important sewer projects, Jackson is using *concrete pipe throughout.*

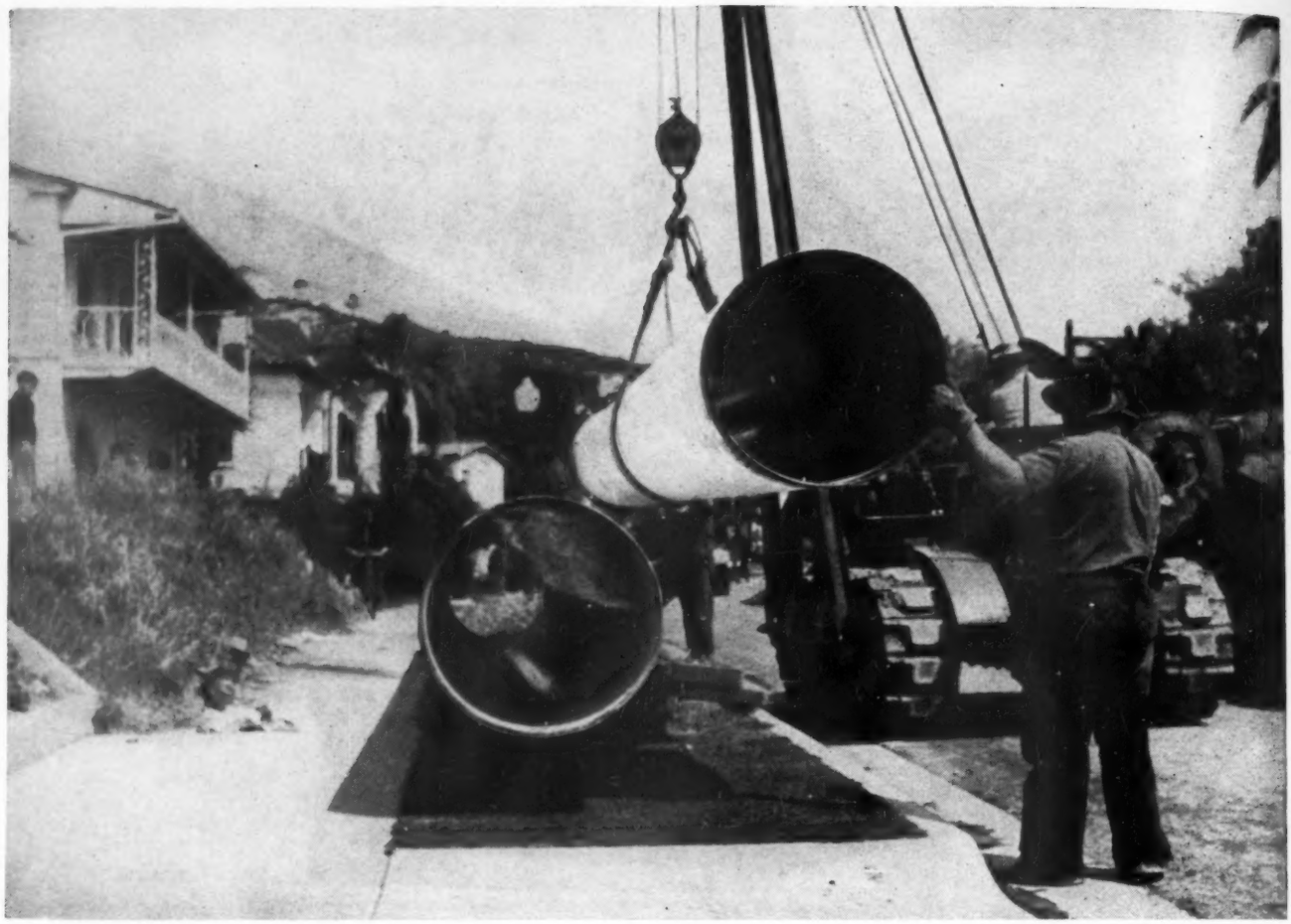
Concrete pipe sewers when properly designed and constructed under a competent sanitary engineer give satisfactory service for generations. They resist abrasion, have excellent hydraulic properties. When properly jointed with portland cement mortar concrete pipe remains on line and grade, and leakage and infiltration *stay* at a minimum.

Reinforced concrete pipe will save money and serve better in your sewerage system whether the sewers are a few inches or many feet in diameter. Write for literature.

PORTLAND CEMENT ASSOCIATION
Dept. A11-29, 33 W. Grand Ave.
Chicago, Ill.

A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work.

Where Millions are at stake, Sewers are built of Concrete



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WATER WORKS & SEWERAGE

Published Monthly by Gillette Publishing Company

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L. H. Enslow, Editor

COMING!

"The Hardest Nut Can Usually Be Cracked"
Is a Public Relations story in three acts and several scenes. The major "scene" (and the toughest on the manager) is Scene I in which Mr. I. Rate Customer storms past the counter girl and into the manager's office at about closing time, to cuss out everybody connected with the water works as either inefficient or crooked. You guessed it; all because of the highest bill he'd ever had—and his family away for the summer to-boot. Act II, Scene 1, is a different picture. This time Manager Wide A. Wake does the talking, after fortifying himself with the report of the Water Work's "G Man" on a round chart before him. Then comes Act III, which might be titled "A Utility Manager's Dream." This playlet in 3 Acts is entertaining reading all the way through. Besides that, it presents a pattern of "what it takes" to do a Public Relations job on a "hard nut." The Author—
D. R. TAYLOR, Plant Sup't.,
Roanoke (Va.) Water Department

"Experiences in Water Main Cleaning"
Are those of the West Virginia Water Service Company, and should be helpful in assisting water utility managers to plan definite action in this same direction if they have been waiting for some further evidence to convince them that main cleaning is worth the cost. Those who have read earlier contributions from the author of this paper will not want to miss this one. The Author—
WM. S. STAUB, Engineer
West Va. Water Service Corp.
Charleston, W. Va.

"Equipping the Sewage Works Laboratory"
Is the contribution of an engineer who has made a real study of the design and proper and necessary equippage of the sewage works laboratory. In essence it is a combination of specifications covering laboratory structures and equipment, plus an order-list for chemicals, glass ware, and the smaller items needed. The Author—
N. C. WITTWER, Supervising Engineer
Rahway Valley (N.J.)
Joint Sewerage System

"A Filter Dressing Rig"
Is a highly useful and economy producing device designed and perfected at the Columbus, Ohio Sewage Treatment Plant. Its adaptation has made for markedly greater speed, less labor and realized economy in cloth and wire required in routine re-clothing of vacuum filters — the most troublesome phase of this modern method of sludge dewatering. We would vote this rig as America's No. 1 "gadget" of the year. The Author—
W. D. SHEETS, Shift Supervisor
Columbus, Ohio

"Significance and Interpretation of Sewage Analyses"
Needs no further explanation than that which the title of the paper provides. We will only add, that with this topic the author has done a splendid job. The Author—
RICHARD POMEROY (Ph.D.) Research Chemist
Los Angeles County Sanitation Districts

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WATER WORKS & SEWERAGE

VOL. 86, NO. 11 *A Gillette Publication* NOVEMBER, 1939

HOOPESTON, ILL. BUILDS SEWAGE TREATMENT WORKS

Constructed Under New WPA—Contract Procedure

By K. V. HILL
GREELEY & HANSEN, ENGINEERS
CHICAGO, ILLINOIS

This article has especial significance. It describes what is believed to be the first W.P.A. project to be handled under regular contract procedure, involving competitive bidding of contractors.

Out of the novel and economical scheme has sprung the little known and interesting W.P.A. Contract Plan now being extended by the Federal Works Agency to a variety of municipal projects.

Since this development should prove of immediate interest to our readers, the article is deserving of the prominent position here given.

THE City of Hoopeston is located in the east central part of Illinois. It is a town of approximately 5,500 population, whose main industries are metal working and food canning.

The Author

The problem at Hoopeston was essentially the prevention of pollution of the watercourse receiving the sewage of the City. This watercourse, which is an artificial drainage ditch, flows into the north fork of the Vermillion River. The Vermillion River serves as the source of water supply for the City of Danville, Illinois, some twenty miles downstream from Hoopeston. Numerous requests of the State Sanitary Water Board to the City to improve its sewage disposal facilities with a view to preventing a nuisance condition in the watercourse receiving the effluent from two existing septic tanks, influenced the City to give consideration to the construction of the sewage disposal facilities herein described. At the time a decision was reached to proceed with the construction of new sewage treatment works, the Public Works Administration was not available for furnishing Federal aid. Accordingly, the City decided to proceed with the work, with the assistance of the WPA. Various methods of procedure, utilizing the WPA, were considered. These were:

(a) City Management Plan
(b) Contract Management Plan
(c) WPA-Contract Plan.

Procedures Considered Analyzed

(a). *City Management Plan.* Under this procedure, it was proposed that the City handle all the work through a qualified superintendent. The City would purchase all materials, hire and pay all labor not furnished by WPA, rent or purchase all construction equipment, and sublet various types of work, such as deep and wet excavations. The advantage of this plan would be the elimination of a contractor's profit. The disadvantages of the plan would be the expense connected with advertising for bids and letting of many separate contracts for wet excavation, piping, valves, reinforcing steel, pumping equipment, and various other pieces of mechanical equipment. Additional disadvantages would be the lack of an experienced organization with the knowledge and facilities necessary to purchase advantageously and to insure the arrival of materials and equipment on scheduled time. Also, under this procedure, the City would have inadequate assurances as to costs before starting the work—a highly important consideration.

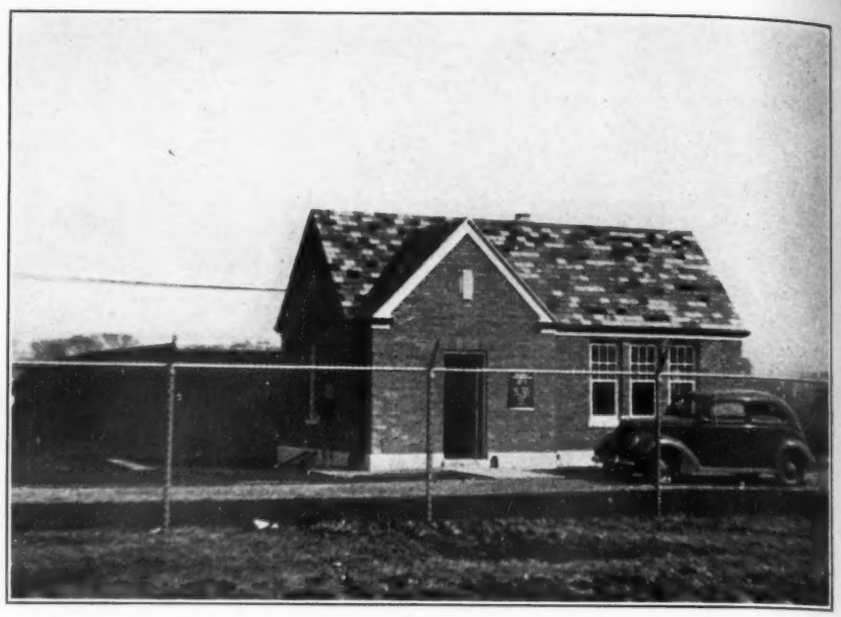
(b). *Contract Management Plan.* Under this procedure, it was proposed to ask contractors to bid on furnishing tools, construction equipment, and supervision of construction. The City would furnish all materials and labor. Thus, the contractor would act as an agent of the City to supervise the work and to

furnish necessary construction equipment. He would be paid actual cost for materials and labor, in addition to a lump sum bid for furnishing tools, construction equipment and supervision. This plan was not attractive to contractors who were interviewed, because they were not allowed to purchase materials and have control of their delivery. Neither was it attractive to the City, because it could not be determined in advance how much the work would cost.

(c). *WPA-Contract Plan.* This was the procedure adopted. Bids were received from contractors for furnishing all equipment, materials, tools, skilled labor, and supervision.

The City agreed to furnish either directly, or through the WPA, the following labor:

	Maximum Number at One Time
Common laborers	30
Semi-skilled laborers	
Pump operators	1
Bricklayer helpers	1
Truck drivers	1
Mixer operators	1
Carpenter helpers	3
Cement finisher helpers	1
Timekeepers	1
Labor foremen	1



The Pumping Station

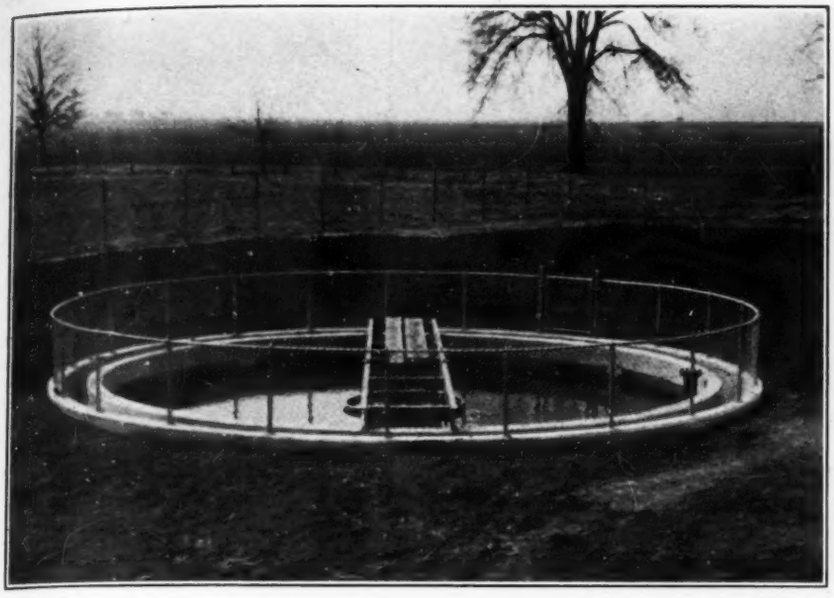
(Much of it salvaged materials—see text.)

The above labor was furnished so as to permit the contractor to work 8 hours per day and 6 days per week. In case of emergency, the contractor was permitted to exceed the above working hours,—the existence of an emergency to be decided by the WPA area supervisor.

If the contractor needed more men than guaranteed under the specifications, he was required to give the City fifteen days' notice, to permit the authorities to negotiate with WPA for the men requested.

The New Treatment Works of Hoopeston, Ill.

Built under WPA—Contract Plan; at cost of $6.25 per capita.



The Secondary Clarifier

The Sewage Treatment Plant

The treatment plant as constructed was designed for a population of 6,000. Inasmuch as the effluent from the plant is discharged into an artificially improved drainage ditch which for long periods has a very low flow, a relatively high degree of treatment was necessary. The plant, therefore, comprises a combined coarse screen and grit chamber, a pumping station housing two 400-gallon per minute electrically driven centrifugal pumps, a laboratory, and a well pump, an Imhoff tank, trickling filter, final settling tank, and sludge drying beds. A 6-inch well 200 feet deep was drilled for a plant water supply. A Venturi meter is provided for measuring sewage flow.

To reduce construction costs, use was made of materials salvaged from the wrecking of an old residence. Thus, two-inch lumber, slate for the roof, window sash, and back-up brick were purchased by the City from the wrecking firm at low cost and furnished to the contractor. These materials were incorporated into the pumping station.

Project Costs

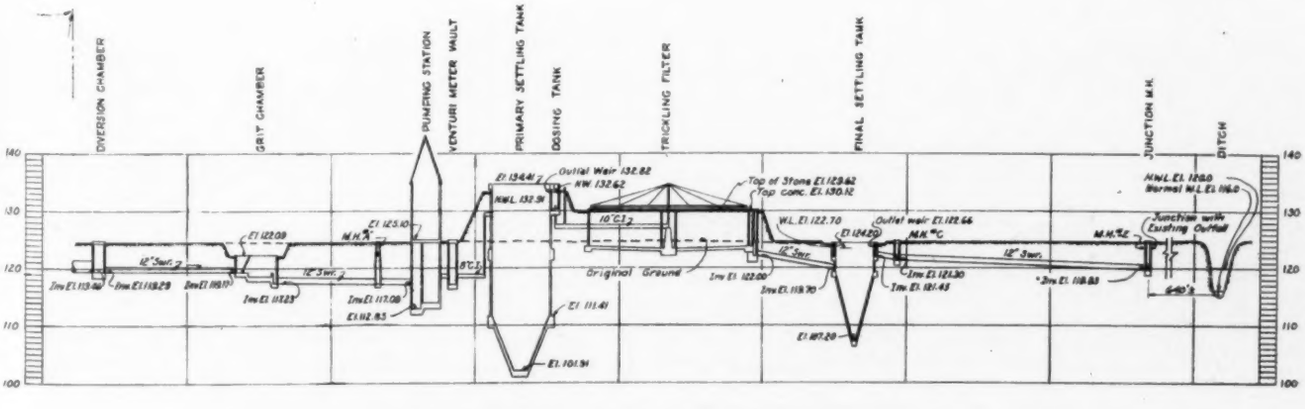
Bids were received from seven general contractors on unit and lump sum items, which items made up the contract cost. In addition, the City received bids direct from manufacturers for the pumping equipment, and the rotary distributor for the trickling filter. Specified allowances were stated in the general contract for these items, and the City agreed to allow or take credit for the difference between the actual cost of the equipment as selected by the City and the stipulated figure.

The influence of furnishing WPA common and semi-skilled labor to the contractor is interestingly reflected in low prices bid, as here tabulated.

Item	*Unit Price Bid*
Earth excavation, dry	$ 0.25 per cu. yd.
Earth excavation, wet	0.50 " " "
Embankment	0.20 " " "
Reinforcing steel	0.045 " pound
Concrete, walls, beams, etc.	10.50 " cu. yd.
Concrete, floors, footings	6.00 " " "
Class B concrete	6.00 " " "
Precast concrete	7.00 " " "
Rubbed finish	0.05 " sq. ft.
C. I. Pipe, B. & S. 12' long	0.04 " pound
C. I. Pipe, B. & S. 3 to 12' long	0.06 " "
C. I. Pipe, B. & S. Specials	0.09 " "
Cement	2.25 " barrel
Iron castings	0.07 " pound

The table below indicates in summary form the engineers' estimates and the actual costs of the project.

	Engineers' Estimate	*Actual Cost Total*	*% of Estimate*
Total Project Cost, including both cost to City and WPA	$67,000.00	$67,064.28	100.1
Total Cost to City	45,000.00	43,603.82	97.1
Total Construction Cost, including both Cost to City and WPA	62,000.00	60,733.46	98.0
Cost for Land, Engineering, and other Items	5,000.00	6,330.82	126.5



Diagrammatic Profile Through Hoopeston Plant

These costs were subdivided, as follows:

Item		*Cost*	*% of Total*
Land		$ 600.00	
Abstract		38.80	0.95
Plans and Specifications		2,500.00	3.73
Engineering Supervision of Construction		2,618.22	3.90
Printing Plans and Specifications		272.50	
Advertising for Bids		34.75	0.46
Testing Materials of Construction		85.38	0.01
Materials Purchased by the City		611.67	0.91
Payments to Contractor		36,842.50	55.00
Total Cost to City		$43,603.82	64.96
WPA Costs			
Labor	$21,446.70		
Cement	2,013.76	23,460.46	35.04
Total Project Costs		$67,064.28	100.00

The City's share of the project costs was defrayed by an issue of $45,000 of general obligation bonds. The bonds were sold at $119.

The work was started on May 7, 1938, and completed March 21, 1939. On the project 51,212 man-hours of labor were furnished by the Works Progress Administration, at a cost of $21,446.70. The actual cost to the City was about $7 per capita, including cost for engineering, land, printing plans and specifications, and other miscellaneous project costs. The cost for the treatment plant alone was $6.26 per capita. Based on a project cost of $67,000, the City's actual cost was about 65%.

General Comments

In general, the procedure chosen worked out well at Hoopeston. The contractor had no complaints regarding labor furnished by the WPA. It is probable that like projects can be carried out successfully in a similar manner in other communities. At Hoopeston, the men employed were all from Hoopeston or near by. They were accustomed to labor involved in "chores" and other tasks connected with making a living in a semi-agricultural community. This consideration is important, because the contractor must have confidence in and knowledge of the kind of labor he is to be furnished, otherwise he will bid high or not at all.

The construction period was somewhat longer than would have been required had the work been done entirely under normal contract procedure. All excavation was done by hand, the only mechanical equipment on the project being concrete mixers, trucks, and an elevator for elevating concrete into the various structures. The contractor used steel panel forms throughout, thus reducing the number of carpenters. The City had the fullest cooperation of the Works Progress Administration, with headquarters at Danville, Illinois, under the supervision of Mr. R. E. Hartz.

E. M. Scheflow of Elgin, Illinois, was the general contractor, Greeley & Hansen of Chicago, Illinois, designed the works and supervised their construction.

ELIMINATING SHAFT DEFLECTION

By W. F. SCHAPHORST, M.E.

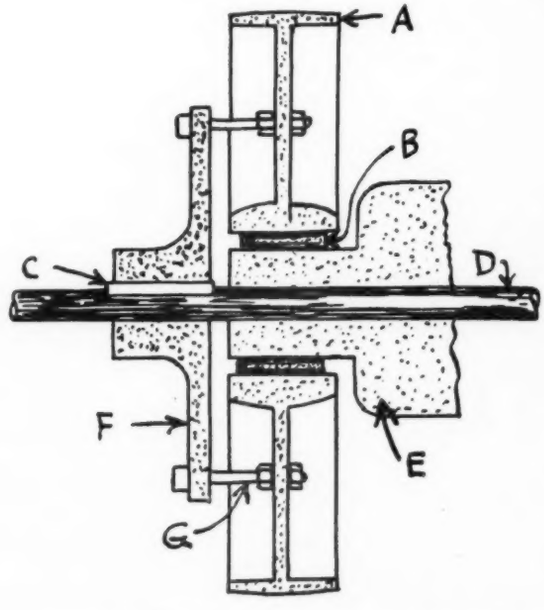
Newark, N. J.

AN excellent way in which every bit of belt pull can be eliminated from shaft bearings is shown in the sketch herewith. Shaft deflection due to belt pull is therefore eliminated also. This method requires less space, and instead of two additional bearings as are sometimes used, there is only one—a roller bearing which consumes less power than ordinary plain bearings.

The sketch shows how, by turning down the housing (E) of the motor (if possible), or by casting such a housing and attaching to the motor and then mounting the pulley on this housing, and equipping with roller bearings (B) between the pulley and hub, all the belt pull falls directly upon the shaft housing. The flexible coupling (F), shown at the left, is keyed onto the shaft (D) and is connected to the pulley (A) by means of bolts (G) or by other methods familiar to all who use flexible couplings.

By applying this method there can be no binding or deflection in the shaft, and friction is reduced to the minimum. No more space is used here than when the pulley is placed as it often is, on the end of the shaft, thereby giving the undesired overhang. With this method the force on the shaft is purely a twisting or torsional action—an ideal condition. The only bending is that caused by the weight of the shaft itself plus whatever the shaft supports.

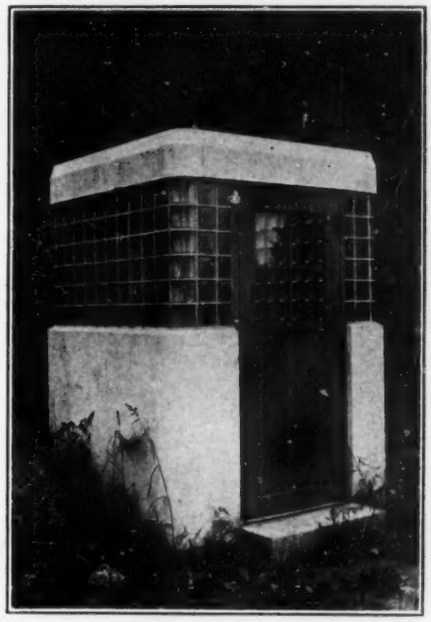
If desired, ball bearings may be used in place of the roller bearings shown. Or, if roller or ball bearings are considered too expensive, simply use a plain bearing instead of the anti-friction type. In any event, this arrangement is more satisfactory than where we have an overhanging pulley. Its first cost may be greater, but in many instances first cost is of much less importace than space and power saving.



ARCHITECTURAL CONCRETE

Its Adaptation in Water and Sewage Works Construction

By W. D. M. ALLAN
PORTLAND CEMENT ASSOCIATION
CHICAGO, ILL.

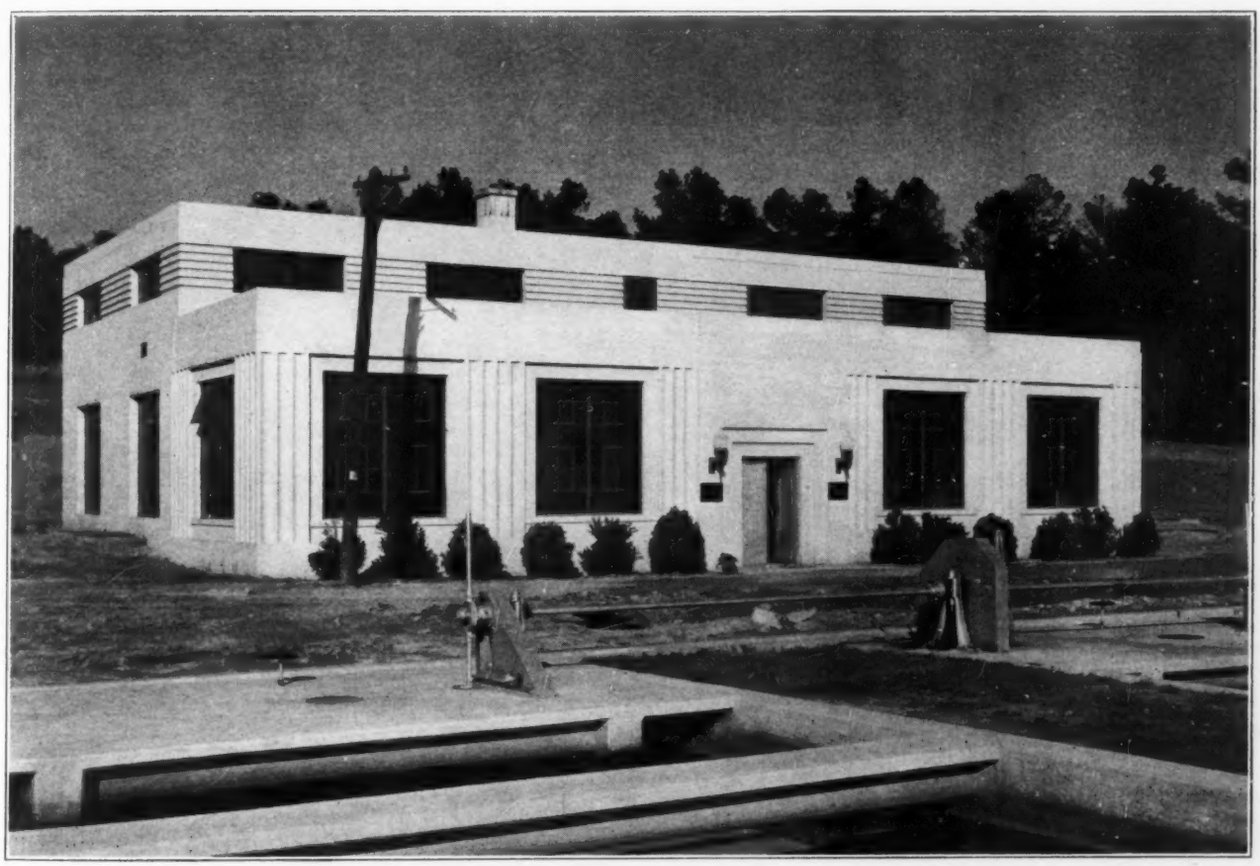


A Chlorinator House
Even such a small structure as this can be made attractively effective with architectural concrete and glass brick.

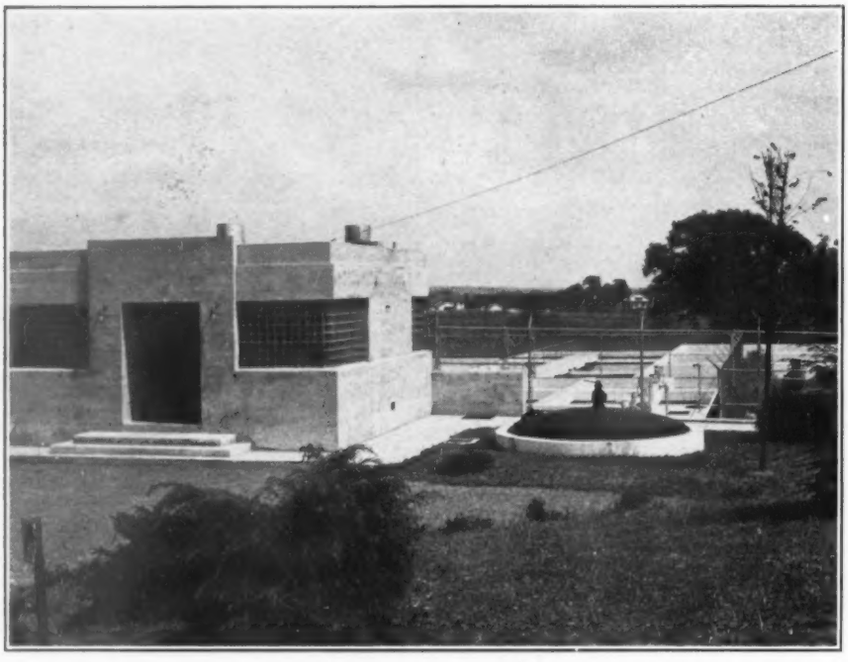
PORTLAND cement concrete has come to be one of the most popular architectural mediums in the design of water works and sewerage structures. It is responsible, in part at least, for a revision of the opinion held by many muncipal officials that such drab operations as water and sewage treatment need not be housed in attractive buildings, in which opinion the added cost has until recently been an important consideration.

There is nothing about architectural concrete that need stump the designer and builder, or be considered unduly expensive. So far as fundamental design principles are concerned there is no essential difference between an architectural concrete building and one constructed of other materials. Primarily, what difference there is lies only in details and not in basic principles or structural considerations.

Whether a building is built of brick, stone, terra cotta or concrete, the surface characteristics of the material have a pronounced influence on the designer's conception of how the structure should look. In architectural concrete the designer has



At Atlanta, Ga.—One of the Smaller Sewage Treatment Plants
Architecturally effective and inexpensive; built entirely with W.P.A. labor to treat about 10 percent of the sewage of Atlanta. For the benefit of the picture the pole might have been removed.



At Boyerstown, Pa.

Simple lines characterize the design of the pump-house at the Sewage Treatment Plant. Here glass brick is effectively combined with architectural concrete.

a material which offers him wide latitude not only in architectural treatment but in surface textures, as well as one that is structurally adequate and extremely low in maintenance.

Success in architectural concrete construction depends mainly on five things:

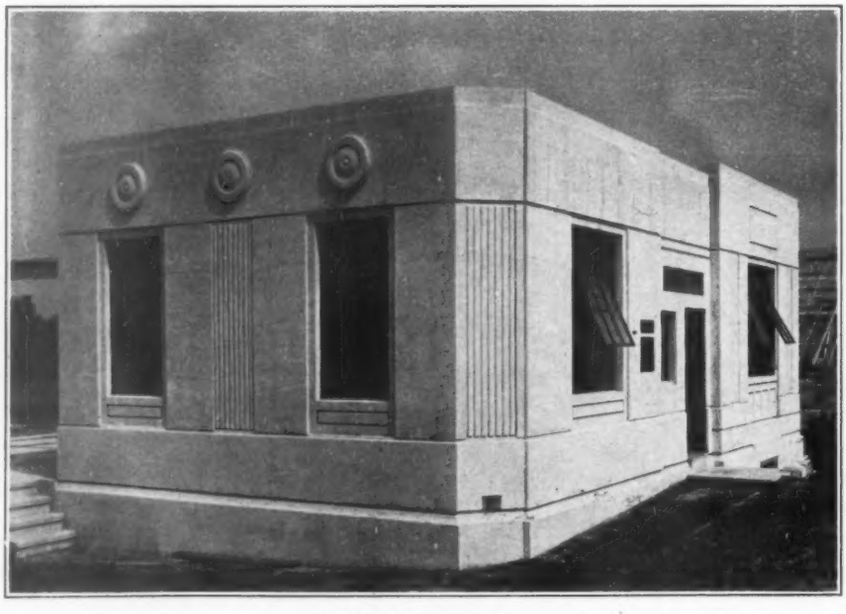
(1) Formwork must be carefully designed and erected.

(2) Form ties should be those that leave the smallest possible blemish on the finished surface.

(3) Concrete aggregates must be proportioned, and concrete must be placed so that finished surfaces will be free from sand streaking, honeycombing or surface irregularities, other than those contemplated in the design.

(4) Construction joints, weakened plane joints and, if necessary, expansion joints should be placed where they will be the least noticeable.

(5) Care must be exercised in curing the concrete and stripping the forms.



At Phoenixville, Pa.

Ornamental detail was produced inexpensively in this Sewage Treatment Plant by tacking wood molds to the form linings.

Structural Treatment

Formwork

When concrete is used as a structural material, and is to be faced with some other material, the function of the formwork is simply to mold and support the concrete until it gains the strength to support itself. Architectural concrete, however, requires greater care in the selection of form materials and real craftsmanship in erection.

Forms for architectural concrete usually are of the wall or vertical type; hence the horizontal pressure exerted by the concrete is the important load for which forms are designed. It has been found from experience that certain maximum spacing of studs, wales and ties should not be exceeded—this, regardless of computed values. Such is true, not because forms would fail if exceeded slightly, but because with reuse of material the deflections may increase and, in addition, because the forms cannot be held to a true line if the members are spaced too far apart.

On the assumption that concrete will be placed at a rate of about 2 ft. an hour, and the temperature may be 50 deg. F. or a little lower, studs should not be more than 16 in.apart on centers when used with 1-in. sheathing or 11/16-in. (or thicker) structural grade plywood. Wales should be spaced no farther apart than 24 in., and ties having a minimum working stress of 3,000 lb. when fully assembled should be spaced not more than 27 in. on centers when used with double 2x4-in. wales.

Ties

Since perfection of finish is the ultimate aim in architectural concrete, ties must be used that will not leave unsightly holes in the finished surface. Ties that can be removed from the wall or that break back the prescribed distance are acceptable. Those fitted with lugs, cones, washers, and similar devices to act as spreaders are not suitable, because they leave blemishes on the surface. In no case should there be metal closer to the finished surface than 1½ in.

As a rule, when a tie is pulled or broken off, the hole it leaves should be no greater than ⅞ in. in diameter. A tie leaving even a smaller hole is preferred. Simplicity is always desirable in form ties. The fewer "gadgets" there are to handle, the

quicker the tie can be installed and removed.

Control of Concrete

Careful control of the concrete to insure uniformity of the quality, and particularly a uniform degree of workability for the conditions under which concrete is to be placed, is especially essential for architectural concrete. Weight measurement of carefully graded aggregates rather than volume measurement will aid greatly in securing accurate control of the concrete mixture. Variations in the moisture content of sand affect the weight but little but, owing to the bulking of sand, affect the volume materially.

To make concrete sufficiently dense and impervious for the exposure to which it will be subject, not over 6½ gal. of water per sack of portland cement and not less than 5½ sacks of portland cement per cubic yard of concrete should be allowed. It is advisable to specify a slump of the concrete as a guide to satisfactory workability. For hand placing, the slump should be under 6 in., and less than 4 in. if vibrators are used; otherwise segregation and sand streaking are likely to occur.

Joints

The technique of construction should be taken into consideration in the design of any building no matter what materials are used. In architectural concrete this is particularly important. Since construction joints are inevitable, they should be definitely located on the architect's drawings. When locating construction joints, a reasonable concrete placing rate should be set up. Generally, 2 ft. per hour should not be exceeded, and a lift between joints of 6 ft. should be the maximum. Although construction joints, when properly made, will be practically invisible, even in a plain surface, it is advisable to provide some detail that will obscure their presence. Horizontal joints are easily obscured by rustications, belt courses and reveals. Joints at the heads and sills of windows are generally inconspicuous even though the wall surfaces between are plain. Vertical joints may be concealed at re-entrant angles, at reveals, or at pilaster edges.

All masonry materials swell and shrink upon gain or loss in moisture in much the same manner that wood does, though in lesser degree. In these volume changes there is always some restraint against free movement between component parts. It is uneconomical and impracticable to provide enough reinforcing to stop cracking entirely, so the practical thing to do is to control the cracking with weakened-plane joints.

Weakened-plane joints may be made by tacking wood or metal strips to the forms. These leave narrow vertical grooves in the concrete. Joints are further weakened by stopping off or cutting the reinforcing at the section. The narrow groove on outside wall is filled with non-staining, concrete-colored calking compound to prevent infiltration of moisture.

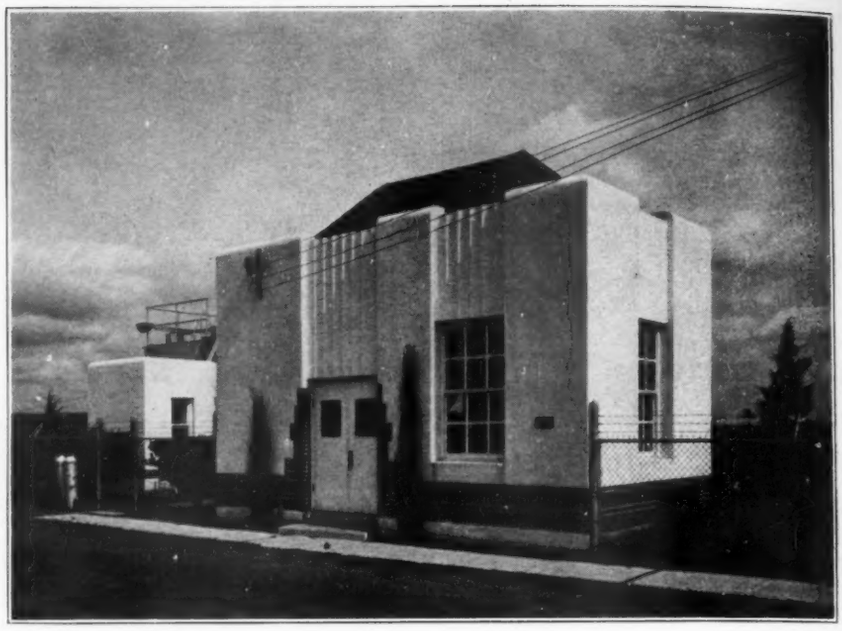
Although each job must be studied with respect to location of weakened-plane joints, it is customary to place them about 15 to 25 ft. apart on exterior walls or exposed cast-in-place interior walls. It is feasible to make them a part of the decorative treatment of walls by locating them in fluting, or vertical rustications.

The Water Treatment Plant of Denver, Pa.

Deep rustications on this structure obscure construction joints. Note that, for architectural effect, the rustications are carried across the Mullions.

Most buildings do not require expansion joints, although under certain conditions of size and plan joints are desirable to separate a building into independent units. Stresses developed will not, then, adversely affect the structure's utility or appearance. Buildings under 200 ft. long seldom are provided with expansion joints. It appears safe to consider that maximum movement at joints located 200 ft. apart will not exceed 1 in. under the most unfavorable conditions.

When expansion joints are to be used, they should extend through the building, forming independent units. It is advisable to place them where they can be obscured by pilasters, reveals, or other architectural detail. As with construction and weakened-plane joints, expansion joints should take advantage of the architectural detail to be made inconspicuous.



At Rayne, La.
Architectural features were achieved in this Sewage Treatment Pant with wide fluting and by rounding off the parapet wall.

Curing and Stripping

Curing is a most important operation in all concrete work. The strength, durability and imperviousness of concrete are dependent to a large extent upon adequate curing. Architectural concrete should be kept wet at least five days. If high early strength concrete is used a minimum of two days is satisfactory. Wet curing means keeping the surfaces soaking wet continually.

Easy stripping of the form is essential to avoid breaking the concrete at the corners or damaging the surface. All forms should be oiled. Excess oil, however, should be wiped off to prevent staining the concrete.

And a Water Tower—
At Assaria, Kan., the designer employed vertical fluted bands to lend stateliness to what otherwise would have been an unattractive structure, heretofore tolerated.

Architectural Treatment

Architectural concrete imposes practically no restriction on the use of cast-in-place ornament. By fastening wood or plaster molds to the form linings almost any desired effects may be achieved from simple and severe flutings to the most intricate traceries.

Wood molds, made of milled white pine, vertical-grain Douglas fir, or other soft wood are easier to erect and strip than are plaster molds. They do not require the care in handling and they take less time to prepare. It is advisable to use wood molds wherever possible, resorting to plaster waste molds only when the desired detail can be formed in no other way. In forming wood molds, however, it must be remembered that wood swells some when wet, no matter how carefully it is oiled. If the wood molds swell and bind, the corners of the detail may break off.

The procedure for making plaster molds varies with the detail of the ornament. A model is made of wood, plaster, clay or some other suitable material. The model is made as a "positive", having the same shape as the detail in the finished concrete. A "negative" is then made, and this is fastened to the form lining. Usually, waste molds are made by ornamental plasterers, the methods employed being similar to those used in staff and fibrous plaster work. Waste molds usually are given two coats of shellac to make them waterproof and non-absorbent. Before concrete is placed, molds must be thoroughly oiled to facilitate stripping them.

Metal molds and forms are used to a limited extent in architectural concrete. As a rule, wood or plaster molds can be used for any detail that can be formed with metal. Metal molds are more difficult to erect. Their choice as against any other type is generally one of economy where reuse is possible in a recurrent detail in the design.

As in all building construction, architectural concrete requires not only competent design and engineering, but construction supervision. The accompanying photographs of some relatively small plants illustrate the variety of effects secured when competent engineering and supervision back up attractive design.

Montana's First Modern Sewage Plant

On Sunday, October 22nd, Lewistown opened to public inspection its new Sewage Treatment Plant—the very first modern sewage plant in Montana of which Lewistown is proud.

Invitations to the dedication were sent out to officials of neighboring cities by Joseph M. Schmit, Supt. of Water and City Engineer, of Lewistown.

THE BLUE RIDGE TANK OF INDIANAPOLIS

Second Large Elevated Tank of Indianapolis Water Co. Reveals Several Novel Design Features

By MILLER HAMILTON
INDIANAPOLIS WATER CO.
INDIANAPOLIS, INDIANA

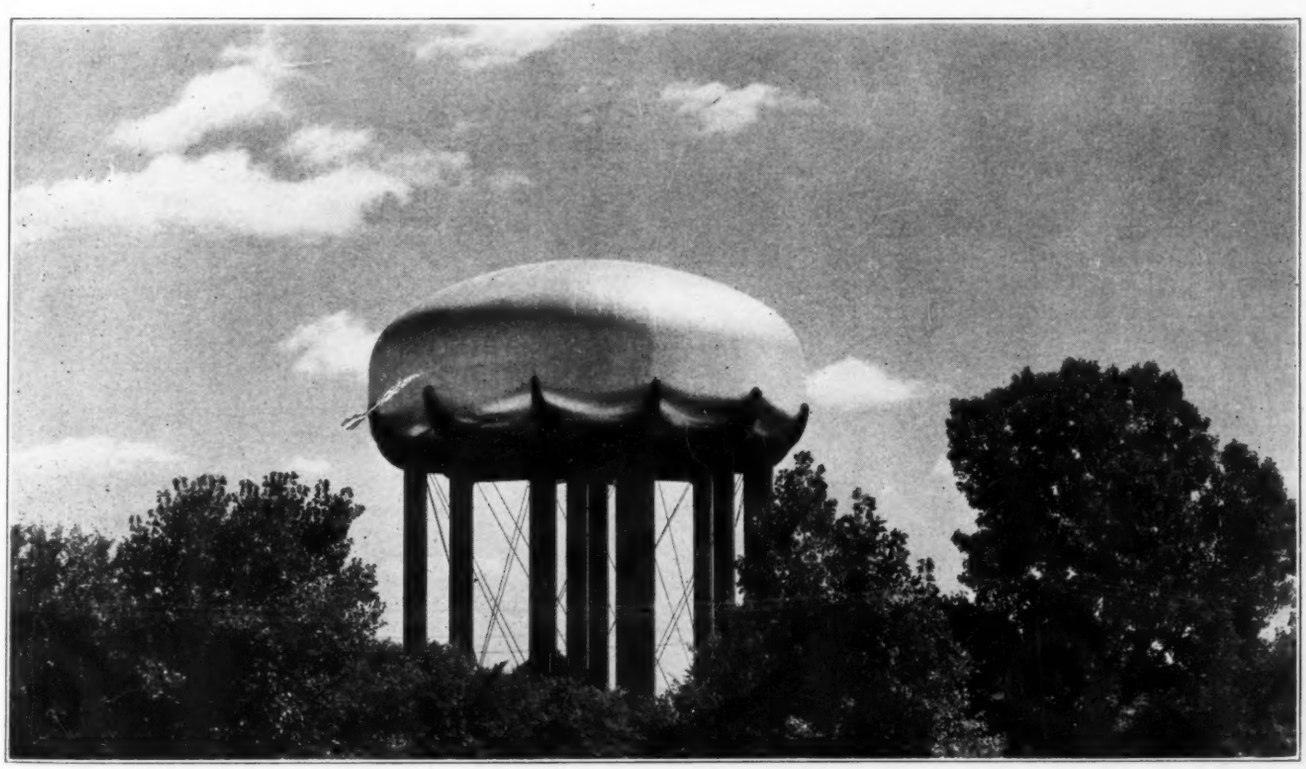
WHEN Hoosier pioneers selected the site of Indianapolis, more than a hundred years ago, they happened to choose just about as flat a piece of land as is to be found in Hoosierland.

Figuratively the city is located in a shallow saucer, and, as with its growth, highly populated neighborhoods came into existence on the highest rims of our giant saucer. So, eight years ago, the Indianapolis Water Company, to better its water service to consumers in the outlying districts, constructed its first elevated water tank in the extreme eastern section of the city, known as Irvington. The ground level approximates 120 feet elevation above the center of our saucer and, likewise, above the principal pumping stations.

The Irvington tank standing 100 ft. above ground level, and holding 1,500,000 gallons, nicely solved the then increasing pressure deficiencies during peak drought periods. Equally beneficial was the sustained uniformity of pressures over the area in question, and consequent operating economies which ensued for the company.

Because of the success with the Irvington tank, during the eight years of service, a decision was made by the company to construct a similar tank in the extreme northwestern section of Indianapolis, where the residential district had likewise begun to climb up on the rim of our saucer. This section is known as the Blue Ridge section.

For many years the company had anticipated a steady population growth in this neighborhood and had installed water mains of large capacity. One of the pumping stations likewise had been built with this neighborhood in mind. But when Butler University suddenly decided to build its new buildings and campus in the Blue Ridge section, and almost overnight the hitherto vacant lots blossomed into homes adjacent to the university, the engineering studies of pressure, volume, and demand, especially at morning and evening peak hours, indicated the day had arrived for a second tank. Its construction



The Blue Ridge Tank of Indianapolis

A stately structure supporting 1,500,000 gallons above the trees on sixteen blending green cylindrical columns.

was started in September, 1938, and it went into service in July, 1939, to give the Blue Ridge area elevated storage of 1,500,000 gallons, and to end the company's worries for some time to come.

Design Features

Reflecting today's streamlining mode, the new tank is spheroidal in shape with a Horton radial-cone bottom. Not even a balcony mars this streamlined effect. Moreover, it is a 100 per cent welded-steel structure, and one looks in vain for rivet heads.

The successful bidder for the project was. The Chicago Bridge and Iron Company.

Aluminum paint is applied to the tank proper and olive green is used on the supports, thus giving colors that blend the best with sky and trees. Under the tank, and around it as far as company land extends, will be a landscaped park in complete harmony with the high class residential neighborhood.

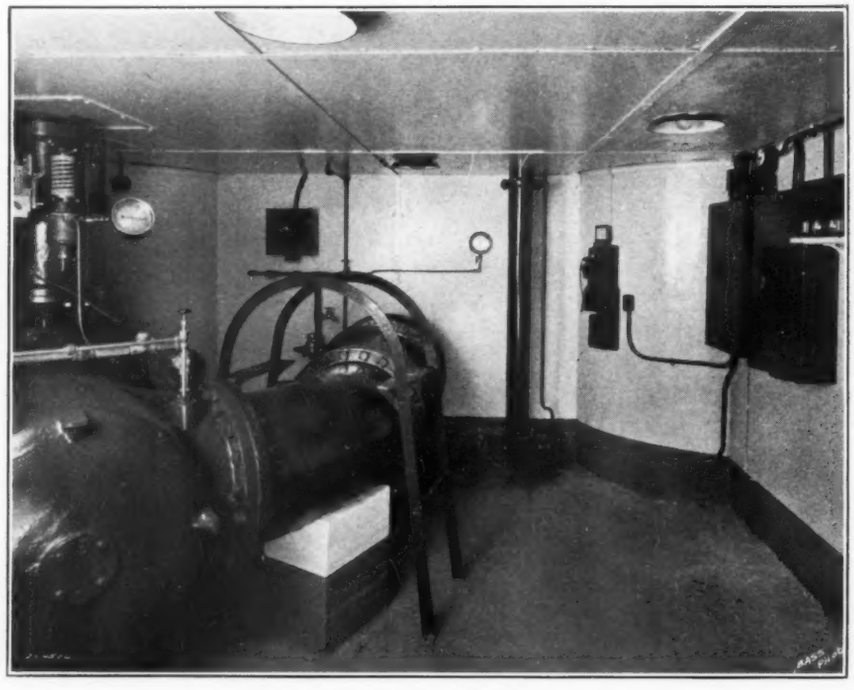
Structurally the design departs from the conventional in several important respects. For instance, the usual large diameter central riser pipe is replaced by four centrally grouped columns. This arrangement is economical and effective in the distribution of weight and permits the control compartment or vault to be placed underground in the center of this group. One of these central columns is utilized as the riser, connecting the tank to the distribution system. Another serves as a utility or access tube to the tank interior. Within this access tube there is a ladder, an overflow pipe, a pressure pipe for flushing and conduits for electric wiring. A weir box is attached at the top and on the outside of this access tube, its purpose being to permit overflow water to escape to a sewer. An opening at the base of the access tube permits the free movement of air to the dome of the tank.

Access to the tank interior is through a flush fitting door in the access tube at the ground level. It is two feet wide and five feet high and is fitted with a screened opening for ventilation. Ladders also are provided on the outside of that portion of the access tube, within the tank and in the riser pipes. Access to the roof is through a hatch in the center of the dome, reached by a stairway leading from a platform surrounding the top of the utility tube above the high water line.

In addition to the four central columns the tank is supported by twelve outer columns. Each of the sixteen tower members is a plain steel cylinder or tube 54 inches in diameter. The twelve outer columns are equally spaced on a circle 78 feet in diameter and the four inner columns on each corner of a 15 foot square. Resting upon the twelve outer columns, and centering about the four inner columns, are twelve radial girders constructed as cantilevers. These girders extend beyond the outer columns nine feet, curving upward and terminating in the outer shell of the tank. Two-inch diameter rods with turn buckles brace the columns.

A Glimpse of the Blue Ridge Community

A reason for devoting pains and time to an architectural study of design and painting of the tank, plus landscaping.



The Underground Control House

On left the 20" cone-valve and automatic level regulation devices. On the right wall, nearest the reader, is the current rectifier employed in the cathodic protection scheme. Note insulated ceiling and temperature and humidity control equipment to preclude condensation.

Electric arc welding joined the several parts of the structure together and no fitting-up holes or rivets were used. The entire tank shell and the tubular columns were butt welded with complete fusion and penetration, either manually or automatically. Shop and field inspection of all welding was supervised by the Pittsburgh Testing Laboratory, whose inspector removed plugs from welded seams and tested them for soundness, for complete fusion, for cracks or undercutting, and for gas or slag pockets.

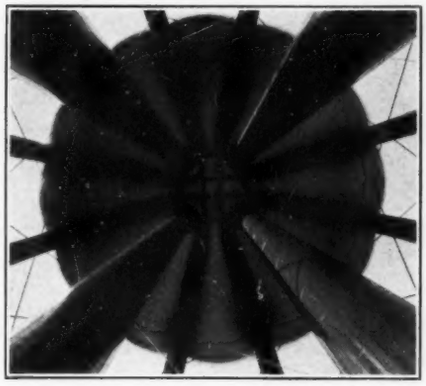
Foundation Features

Preliminary borings at the site indicated the advisability of extending the foundations to a point 21 feet below the surface of the ground in order to reach good bearing soil. Because of this extraordinary depth special structural considerations entered into the foundation design. The structure rests upon sixteen cylindrical piers each 6′-2″ in diameter and 16′-6″ deep and these in turn bear upon an outer circle of twelve truncated pyramids 5′-6″ deep, each having a base of 18 feet square and on a central pyramid whose base is 36′-8″ square which supports the four central piers. The foundation structure is of reinforced concrete. The dead load of water, steel, concrete, and the earth backfill on the pyramids transmit a unit bearing of 5,360 pounds to each square foot of gravel soil. The work was done by the Fatout Building Company of Indianapolis.

Automatic or Remote Control of Level

Control of the water level in the tank is automatically accomplished by means of an hydraulically operated 20-inch diameter [cone-plug type] altitude valve in the vault at the tank center. A water pressure device mounted on the altitude valve serves to automatically close the valve when the tank becomes full, and to open the valve whenever the water pressure in the adjacent mains drops a pre-determined amount.

Electrically operated devices transmit, indicate, and record the tank level continuously at the pumping station several miles away, thereby dispensing with the services of an attendant at the tank. Other electrical devices automatically send a signal to the pumping station when the altitude valve has closed and again when it has opened. Transmission of these levels and signals is over a pair of telephone wires. If for any reason it is desired to close or to open the altitude valve remotely from the pumping station, there is also an electrical arrangement by means of which the station operator may do this manually and know by a return signal that it has been done.



Worm's Eye View

From exact center of the 16 tubular columns.

Control House Eliminated

Ordinarily a control house is built over the feeder main at a point near the tank. In this instance the conditions of foundation depth and column spacing suggested an arrangement whereby the conventional control house super-structure could be eliminated without inconvenience. Consequently, an instrument room was built below ground and provided with access stairs. Freezing of small water pipes which operate the hydraulic cylinder of the cone valve is prevented by insulating the walls and ceiling of the vault and by providing a thermostatically controlled electric heater. Because moisture is detrimental to the delicate electrical devices described, the control room is kept dry by circulating heated dry air automatically controlled by a humidistat.

The altitude valve was supplied by the Chapman Valve Company of Indian Orchard, Massachusetts; the water level transmitter and receiver by Esterline & Angus of Indianapolis, manufacturers of electrical metering instruments; and the signaling devices by Robert Annis of Indianapolis, maker of special instruments.

Airplane warning lights are maintained on the tank dome and are controlled by a time-switch which automatically operates them on a prearranged schedule. Lights have been provided in the utility tube and the tank for convenience in reaching the dome and when flushing or painting the interior.

As a precautionary measure a weir has been built near the top of the utility tube which, in the event of the altitude valve not closing according to schedule, will permit water to escape into a 12-inch overflow pipe. This pipe passes down inside the utility tube and discharges into the sewer. A 6-inch drain connection at the base of the inlet riser permits the contents of the tank and riser to be completely drained. A pressure-water connection 3 inches in diameter enters the tank through the wall of the utility tube just above the floor line for the purpose of hose flushing the tank interior.

The Access Tube

This supporting column of 54″ diameter serves as access tube into the tank above flow level. It contains a pressure water line and electric cables.

Cathodic Protection Provided

One of the several interesting features in connection with the new Blue Ridge tank is the fact that its interior is *not* to be painted below the predominating water level line. Instead, the interior walls are being protected from rusting and pitting by electrical corrosion-prevention devices, installed by Electro-Rust-Proofing Co. of Dayton, Ohio.

These electro-chemical devices, providing what is termed "Cathodic Protection," have been installed to prevent the formation of rust. In consequence, no paint is to be applied to that portion of the tank interior that comes in contact with water. (The above water area will be painted as usual.) The method is based on the theory that cathodic protection assumes that rust proceeds from the liberation of hydrogen at the surface of the iron in the presence of moisture. This tendency is arrested by

passing an electric current through an electrode (the anode) into the water, and radially through the water (the electrolyte) to the tank plates (the cathode).

Direct current electricity regulated to control amperage and voltage is discharged at the electrodes in amounts suited to the process and to the water through which it passes. In the new tank these electrodes (six in number), made of stainless steel rods ¾-inch in diameter and 23-feet long, are suspended and insulated from the roof trusses at equal spaces and a uniform distance from the tank plates.

The specification concerning the elimination of interior painting and substitution, therefore, of cathodic protection, appears to be original with the Blue Ridge tank installation. Results will be awaited with considerable interest and may spell a new era in protecting submerged water works structures of steel and iron.

Apparently the first application of cathodic protection to tanks and standpipes was that at Dayton, Ohio (1936), and it has been used since by several other cities. Experience with the method appearing satisfactory, the company has in addition to the Blue Ridge installation adapted it for the eight-year-old Irvington tank. Comparative figures on the current consumption, etc., in connection with the protected interior (Irvington) after 8 years of service and the unpainted interior (Blue Ridge) will prove both interesting and revealing. The comparative net costs of the two schemes of rust prevention and maintenance should be available amongst other data obtained of a critical nature for future planning.

Attainments

With the new tank floating on the line 1,500,000 gallons of water held automatically in storage will nicely fill the requirements of the customers and bring this section of the city up to the standards maintained in all other neighborhoods. Furthermore, fire protection is placed in the same high rating as enjoyed by other districts. The tank, rather than the pumping stations, will compensate for the violent fluctuations in rates of demand, and this uniformity in pressure will be appreciated by our customers almost as much as they will appreciate the increased pressure and flow from the outlets in their homes and yards.

"PARADISE VALLEY"

This picture struck us forcibly for two reasons and is consequently reproduced.

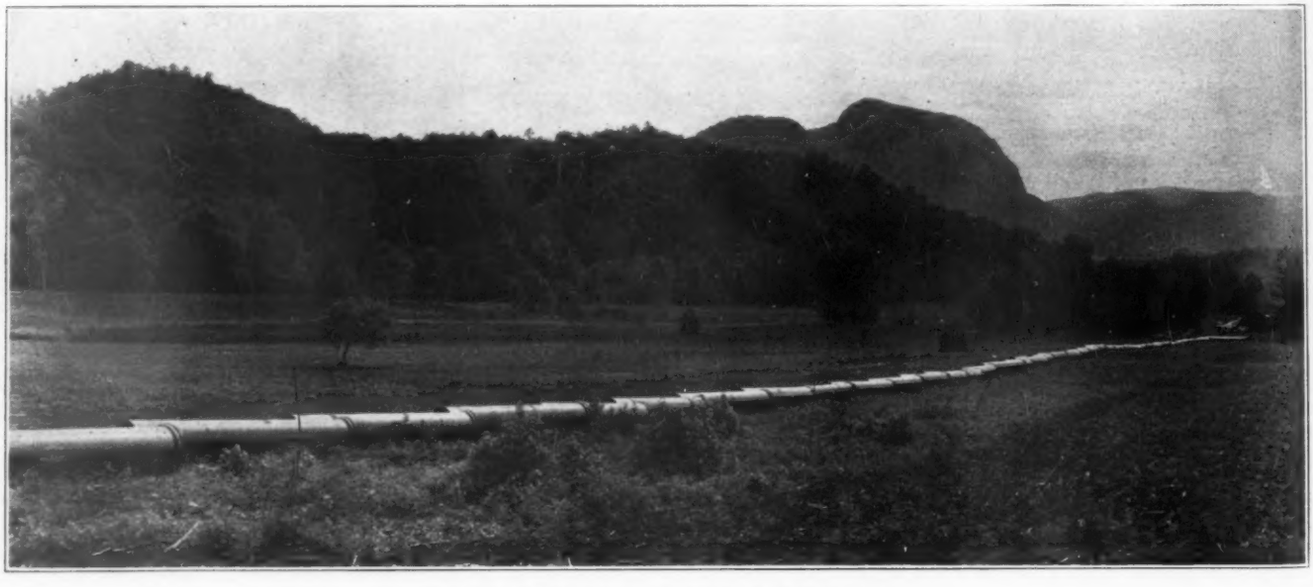
First: the picture itself; it's not "Paradise Valley" but we think it should be so named. Running northwesterly from Greenville, S. C., it starts at the scenic reservoir of Greenville, above which towers famous Table Rock here visible in the edge of the "Land of the Sky."

Second: Through this valley, bringing water of excellent quality from Table Rock Reservoir to thriving Greenville's textile mills and residences, now runs a second "thread of progress," here seen on the surface. It is now a pipe line.

Greenville took courage in 1925 and constructed Table Rock Dam and 17 miles of 30″ Cast Iron pipe line to bring in the water, primarily because industrial growth was stymied without a generous supply of water of high quality. And this was before the "golden era" of the late 20's had opened.

Now, only 15 years later, Greenville has outgrown the single 30″ main and the second "thread of progress," a paralleling twin 30″ main, of Birmingham produced Mono-Cast Centrifugal pipe is going in. (Said to be the largest order for 30″ C.I. pipe ever placed in the U.S.A.—viz. 121,000 ft. weighing 16,000 tons.—Ed.)

Thus has again been proved the great value to a community of an adequate supply of industrially satisfactory water, and the wisdom of taxpayers having the vision to go in debt for such an asset as did the prospering little city at the foot of "Paradise Valley" in South Carolina.



Through Which Runs a Thread of Progress

MICHIGAN'S A.W.W.A. SECTION AND OPERATOR'S CONFERENCE

Join Hands in Staging a Meeting of Parts

IN LANSING for a three day meeting September 20th-22nd, the two year old Michigan Section of A.W.W.A. and the seven year old Michigan Conference on Water Purification held their second joint meeting, to establish a record attendance of better than 250. The official registration of 220 compared with 198 for the 1938 meeting, but at least 30 who came late did not register.

This reporter was impressed with the full and prompt attendance of the technical sessions; also, the close attention given the papers and discussions throughout. It was not all work and no play, however. For instance, on the first evening there was a smoker and buffet supper at which Michigan State's Coach Bachman made a talk that was followed by a humorous skit put on by "Ham Actors" in the two associations. Then there was the afternoon devoted to recreation and the big dinner and dance; teas and a theater party for the ladies.

"Grass Rooters" vs. "Detroit Metros"

On the second afternoon was staged the annual clash between the two ball teams of the Conference—the "Detroit Metros," mis-managed by "Doc" Hurlbert, vs. the "Grass Rooters," billed as the State at Large team, seeking revenge under "Pa." Harry Potts. There was no walk-away for either team and the nip and tuck 9-round battle saw the "Grass Rooters" come from behind to knock out of the box the whole string of "Metro's" ace pitchers, and to win what proved to be a top-notch game to recover the cup lost in the 1938 engagement. Highlights of the game—brilliant playing of Ray Faust; catcher "Newt" Power's "coming out party" (see picture of emergency field repair job); "Doc" Hurlbert's "boner"; Harry Pott's fan-out that brought him a presentation of a bat of telephone pole dimensions; lots of fun by everybody.

Some Good Philosophy Dispensed

The annual dinner was presided over by Midland's Paul Stegeman, as the toastmaster, who proved something of a poet, and who disclosed his "discovery" that there were only two professions which dealt in materials straight from Heaven — the ministry being one, and the water works profession the other.

The Retiring Chairman
Cyrus R. Bird
Engr.
The Pitometer Co.
Detroit

The New Chairman
R. J. LaMarre
Chemist
Water Department
Detroit

Harry Jordan, AWWA's secretary, proud of the new Michigan Section and its continued member gain of 20% during the year, stated that proof of the wisdom of splitting the old Central States Section up into four State Sections was apparent from the fact that the four sections now boasted 416 members in comparison with the 282 in the same territory prior to the split up. Meeting attendance had been markedly increased because of reduced travel distances and enhanced interest.

Then came a "stop, look and listen" address by one Dr. O. R. Yoder, Supt. of the Ypsilanti State Hospital, who dispensed a three-decker sandwich of philosophy, common sense and psychology, seasoned with humor, which was relished by all of his listeners—even those who could vision tall glasses and hear the tinkling of ice on the floors above. In essence, Dr. Yoder's text was—"mix a bit of play with your work, and don't take yourself so damned seriously." When he was through we decided to be ourselves, and to "Stop, Look and Listen." Reasoned, if we couldn't fly to Ireland in a "crate" like Doug. Corrigan did, we might at least try to be like Dr. Yoder's wiry buckwheat and less like the wheat that top-heavily lays down when the blow strikes. If more of us could remember the nuggets in the Doctor's talk every morning before breakfast we would all be better and happier citizens. So; on with the dance which followed, and a pleasant evening by all.

Fuller Award to Lenhardt

To L. G. Lenhardt, General Manager, Board of Water Commissioners of Detroit, went the 1939 Geo. W. Fuller Memorial Award, "for his activities in promoting legislation productive of the Michigan Lien Law, protecting Water Departments against loss of revenue."

As chairman of the Sectional Committee on Aims and Objectives, Mr. Lenhardt later in the meeting reported that two other bills helpful to water utilities had been passed, and one which would have placed a State sales tax on water was defeated. Michigan's Operator Licensing Act was withdrawn on the score that it would jeopardize the Civil Service status of operators.

Officers Elected

The following were elected officers for the ensuing year.

Michigan Section:

Chairman—R. J. La Marre, Supt. of Filtration, Detroit

Vice-Chrmn. — L. E. McQueen, Supt. of Public Works, Coldwater

Secy.-Treas. — M. N. Gerardy, Engr. Water Dep't., Detroit

Trustees—R. J. Faust, State Dep't. Health, Lansing; H. H. Caswell, Mgr. Water Dep't., Ann Arbor; E. E. Norman, Sup't. Public Utilities, Kalamazoo.

Michigan Operators' Conference:

Chairman—W. J. Russell, Sup't. Water Dep't., Benton Harbor

Vice-Chrmn. — Sidney De Boer, Sup't. Filtration, Grosse Point

Secy.-Treas.—Ray J. Faust, State Dep't. Health, Lansing

To the Executive Committee—J. A. Parks, Chemist, Detroit; James Galloway, Sup't., Marysville.

Conference Secretary
R. J. Faust, Engr. Michigan Dept. Health

Section Sec'y.-Treas.
Maurice N. Gerardy Engr. Water Department Detroit

Technical Sessions

Considering the general excellence of the papers presented we find ourselves rather hard put to do justice to several in the space available for this report. We shall in consequence be forced to do no better than highlight these papers, whereas many more pages could be filled with more meaty digests if the space could be had. For the excellence of the program our compliments to the officers and speakers; for the lack of space, our apologies.

"The Water Department as an Independent Utility"—by DONALD C. EGBERT, City Manager and Sup't. of Utilities, Birmingham, Mich.

In his splendidly thought-out and well prepared paper, Mr. Egbert made an excellent case for a defendant claiming that a Water Department should be operated as an independent utility completely divorced from municipal government and protected against diversion of income to other municipal operations. The latter practice he considered tantamount to another hidden sales-tax placed on these small consumers, least able to pay what should justly be paid by wealthy property owners in the form of taxes or assessments.

The following he set up as policies advocated for every Water Department:

(1) A complete and irrevocable divorcement from general municipal government.

(2) Financed, managed and operated as an independent utility for the good of all concerned.

(3) Practice long term planning in maintenance and operation; and, most important, for betterments, expansion and financing.

(4) Payment into the General Fund of taxes plus a nominal return on the invested capital, seemed both equitable and proper since the city's money was tied up in the investment.

(5) Budgetary control, with yearly audits.

(6) Reports to the public in readily comprehended form, for the purpose of establishing and maintaniing good will and securing support.

[To us, these 6 paragraphs say much.—Ed.]

A.W.W.A. Director
George H. Fenkell Cons. Engr. Detroit

Retiring Conference Chairman
James A. Parks Chemist Water Department Detroit

Mr. Egbert, in reply to questions, stated (1) That some form of charge for fire protection should definitely be paid by the city to the Water Department. (2) That use of Water Department funds for other purposes was proper if done on a loan basis, pointing out that Birmingham's transfers to the General Fund amounting to $100,00 was now being repaid in water works financing.

PAUL STEGEMAN (Sup't. Midland, Mich.) pointed out that water rates in small communities, if sufficient to pay all charges, would prove excessive because of the high investment per consumer in order to provide ample fire protection and to secure efficient management and operation of modern systems.

GEORGE H. FENKELL (retired Gen'l. Mgr., Board of Water Commissioners, Detroit) in answer to a question raised, stated that in water works financing depreciation was relatively unimportant because proper maintenance should keep the system up to 85% or better of new value. Obsolescence of equipment was more important than depreciation through wear and tear. More recently it had been held that any considerable surplus should not be built up to finance major utility improvements, because such should be paid for out of future earnings as the more equitable procedure.

More "Brass Hats"
Jas. Galloway, Plant Sup't., Marysville; (Member Conference Exec. Committee); H. H. Caswell, Mgr. Water Dep't., Ann Arbor; Earl E. Norman, Sup't. Utilities, Kalamazoo (Trustees of Mich. Section)

"Handling and Feeding Carbon" by NEWTON POWERS, Chemist, Water Dep't., Detroit.

Mr. Powers' paper contained several valuable pointers in handling and feeding of powdered carbon. To prevent dust scattering the machine hoppers had been fitted with an extension box providing a snug fit for the slit carbon bags being emptied. (Proof of its effectiveness was apparent in a movie film shown.) To prevent fire hazard a thermocouple in the hopper sounded an alarm. Water sprays within the hopper were then turned on by the operator, only after checking to determine that a fire really existed. Hopper arching had been alleviated by Syntron vibrators attached to the hopper walls. From the feeders (weigh-control type) the carbon is wetted with water sprays in the drop funnel which is connected to an educator, thus creating a continuous down draft through the machine to preclude moisture creep. Mr. Powers stressed the value of a dependable stop gate in the drop tube between the hopper and the feeder proper.

In reply to questions Mr. Powers said that both Detroit plants use carbon, either to the coagulated water, or just ahead of the filters, or at both points. However, routine involves feeding at the head of the basins only at rates of 2 pounds per million, which brought questions from the floor as to what good could be accomplished with dosages of 0.24 ppm. of carbon. (If Detroiters knew the answer to this one they refused to disclose the secret.)

Porous Filter Bottoms

"Porous Plate Filter Bottoms at Flat Rock, Mich."—by LORIN R. STEVENS, Sup't. of Filtration, Ford Motor Co., Flat Rock, Mich.

Mr. Stevens' paper, which is to appear in a forthcoming issue of this magazine, describes the porous plate bottoms recently installed in all units of the Flat Rock plant of the Ford Motor Company in order to rid the filters of the trouble making gravel beds and corroding underdrain piping, and to secure better washing and higher filtering rates. The plates, 11⅞" square and 1¼" thick, are of the same material and manufacture as those employed for air diffusion

L. G. Lenhardt
Genl. Mgr.
Water Board of Detroit
(To Him the Fuller Award)

Paul Stegeman
Sup't.
Water Dep't.
Midland
(Toastmaster-Poet)

in sewage treatment. Specifications of pore diameters approximating 0.45 min. called for a permeability rating of 45 to 55 c.f.m. of air per plate at 2" water head loss, and head loss of only 6 to 10 inches at water rates of 20 g.p.m. per sq. ft. of plate area. Laboratory solubility tests proved the material insoluble in alkalis, acids and chlorine water.

The installation was made by welding cadmium plated rolled steel bars across the tops of the existing laterals. These bars were pre-drilled and threaded for phosphor-bronze stud bolts with washers supporting each plate at its four corners and held in place by top washers and nuts. The spaces between the abutting plates were filled with rich cement mortar. On top of the plates was placed a 3" layer of torpedo sand and 30" of sand of 0.52 effective size and 1.2 uniformity coefficient.

Mr. Stevens said that the installation was too recent to give operating experiences beyond reporting that the expected uniformity of wash and the greater bed expansion sought had been attained.

HARRY T. CAMPION, Sup't.

Programmers

D. C. Egbert, City Mgr., Birmingham; Harry Campion, Sup't. Filtr., Grand Rapids; W. D. Loreaux, Sup't. Water, Dundee

Filtration, Grand Rapids, Mich., in reporting on experiences resulting from 3 years of operation of two filters equipped with porous plate bottoms in the Grand Rapids softening plant, made the interesting comment that although the filters removed 10 to 18 ppm. of carbonate hardness the porous plates had not yet been clogged with carbonate deposition. The explanation probably lay in the observation that practically all of the carbonate encrustation occurred in the first few inches of downward travel through the 30" sand bed. Frequent bottom inspection showed no lossening of the plates, which were bolted to ridge and furrow bottoms at four corners.

With the new bottoms the wash rate had been reduced from 32 to 27 inch rise and the low loss of head had not built up appreciably in the 3 years of service. He would prefer a bituminous joint between plates to the cement joint used at Flat Rock.

Victors and Vanquished

Rival ball teams of the conference wage annual battle in which Michigan's "Grass Rooters" (above), under management of Penna. Salt's Harry Potts, regains the ornate tin funnel from "Doc" Hulbert's flashy "Detroit Metros." (Star player, Ray Faust; puller of biggest boner, "Doc" H.)

It was pointed out in the discussion that a scrubbing air wash could be used in combination with water wash without danger of disrupting the beds. The plates cost $2.00 each.

"The Venturi Meter" by EVERETT M. JONES, Sales Mgr., Simplex Valve and Meter Co., Philadelphia.

Talking from lantern slides, Mr. Jones discussed the elements and basic principles of the Venturi tube, and its many adaptations in modern water and sewage treatment. The striking part of Venturi tubes for metering had been the non-changing coefficient and simplicity of checking for accuracies at various flow rates, and re-calibration if the necessity arises. As to accuracies, it was common to find an accuracy of 99.5 to 100.5%.

Mr. Jones also discussed features of modern indicating and recording instruments, with especial emphasis on the transmission of pressure differentials from the Venturi tube by air pressures, thus avoiding the limitations and troubles experienced with wet lines. Concerning maintenance, cleaning of the annular throat chamber of tubes should be done every 2 weeks in some instances, in others every two years, depending upon tube duty. A check up every 6 weeks was advocated until a longer interval can be proven sufficient.

Problems

"The Small Water Department" —by JAMES GALLOWAY, Plant Superintendent, Marysville, Mich.

Mr. Galloway in a splendid and interesting paper told of the problems of a small Water Department operating head in coordinating the various units concerned, at a minimum of overhead. Marysville, too small to employ a full time superintendent of filtration, puts meter maintenance under the chief operator of the filter plant. A full accounting system is kept up by the City Clerk, including billing. The latter operation, however, was soon to be moved down to the filter plant. Purchasing of major items was done after consultation with the Mayor-Manager. Maintenance of the distribution system (valves, hydrants, etc.) was being handled by the Dep't of Public Works.

It was apparent from the discussion that ensued that the small Water Department is anything but a small topic, as Mr. Galloway had stated. One of the most serious matters dis-

(1) C. C. Roden, Jas. B. Clow & Sons, Detroit; (2) Geo. Golden, Sup't. of Water, Highland Park; (3) "Walt" Smith, W. & T. Co., Detroit; (4) Karl Schwanbeck, Sup't. Filtration, New Baltimore; (5) "Jo" McCarty, R. D. Wood Co., Cleveland; (6) Paul Teifer, Sup't. Meters, Trenton (ex-hoofer and entertainer extraordinary—prefers his water-works job and sleeping at home); (7) Earl Smith (a real mechanic who knows Diesel engines and water meters, came from Badger's Milwaukee shop into the selling game to make good); (8) Lorin R. Stevens, Sup't. of Filtration, at Ford's Flat Rock Plant. (Saw what porous plate filter bottoms were doing at Grand Rapids persuaded Ford authorities to let him install them at Flat Rock.)

cussed was the question of purchasing modern efficient equipment or chemicals, in which case the plant manager does not receive the authority asked. The problem then was who is responsible in the event of an operating failure which results in an epidemic, property damage, fire loss or complaints of water quality.

It was also brought out that the small Water Department needed all possible assistance from the State Dept. of Health engineers in the control of treatment processes and equipment. They could be of great assistance in securing needed equipment.

A motion to appoint a committee to study the several questions raised by Mr. Galloway was referred to the Committee on Aims and Objectives. The big question was—"How much load should any one man be expected to carry?"

"Handling of Complaints" by GEORGE GOLDEN, Sup't. of Water, Highland Park, Mich.

Mr. Golden said, that since the introduction of activated carbon and elimination of tarred jute, the most numerous complaints had been of high bills and poor pressures. The latter had been due to carelessness of plumbers in not turning curb cocks full open after repairs, and to hot water damaged meters and corroded service lines. The "problem children" were the fellows who attempted to read their own meters and slipped a sypher in doing so; likewise the man who "never received the bill" when notified of the penalty imposed for late payment. He told of one case of complaint of red worms in a glass of water, which by a little detective work proved to be lint from a cheap towel.

J. J. WERNETTE, Sup't. of Water, Grand Rapids, told of successful use of the recording "Meter-Master" in settling complaints of meter accuracy and high bills, right on the premises of the consumer, and saving much grief and the cost of meter replacement.

H. H. CASWELL, Sup't. of Water, Ann Arbor, Mich., settles complaints by having questioned meters sent to the University of Michigan Testing Laboratories. If the meter is fast the customer agrees to pay the testing charge—and he usually loses. If slow, the Water Department has already lost more than the testing charge, and the customer is satisfied in either event.

The Fuller Award Committee

W. C. Hirn (Detroit); J. A. Keils (Mt. Clemens); Hal. Smith, Chairman (Detroit); Owen McCarthy (Dearborn)

"Cross Connections" by WM. C. HIRN, Pate and Hirn, Engrs., Detroit.

Mr. Hirn called attention to the interesting fact that in 1913 Michigan boasted only 6 filter plants, supplying 210,000 people, whereas, in 1938 the number had grown to 47 plants supplying filtered water to more consumers (3,300,000) than there was total population in Michigan in 1913. With the purer supplies the hazards from cross connections became the more important. Michigan since 1938 has had regulations prohibiting a physical cross connection in any form between a non-palatable industrial supply and municipal supply. Now with much heard concerning interior plumbing hazards, much remains to be accomplished in eradicating this hazard. A most essential step would seem to be a closer cooperation between the Building Department and the Water Department. In the end it seems likely that the Water Department will be charged with the responsibility of checking, approving and supervising plumbing. (Just one more thing for the small Water Department head to worry with. Page Mr. Galloway of Marysville.—Ed.)

R. J. FAUST, State Dep't. of Health, named three recent outbreaks traced to faulty piping and plumbing conditions, resulting in back-syphonage at State institutions. Pressure gauge records would have revealed the hazard, which was corrected by increasing the size of supply pipe from the mains.

Maintaining Electrical Equipment

"Maintenance of Electrical Equipment in Water and Sewage Plants" — by, C. J. SCHOENINGER, Water Dep't., Detroit.

Mr. Schoeninger's treatise on maintenance of electrical equipment should be valued by every one concerned with operation and care of electrical equipment. To our thinking it is probably the best thing of its kind to be made available to water works and sewerage operators.

Prerequisites listed in maintenance were: (1) Complete schedule of maintenance, and effective pursuance; (2) Adequate inspection and testing equipment; (3) Assign specific duties assigned to individuals; (4) Every motor assigned a number.

In motor cleaning a vacuum cleaner is to be preferred to a blower, even when limited to the permissible 50 lbs. pressure at the nozzle. Commutators and slip-rings should be kept smooth with hand stones. Brushes should be removed for monthly cleaning, those worn more than 1/8 of their length replaced.

(1) *Burke Lyden, Lyden & McFarlin, Engrs., Youngstown, Ohio;* (2) *Armand Picard, Engr., Water Board, Detroit;* (3) *Geo. F. Landgraf, Chief Engr. Water Dep't., Royal Oak;* (4) *H. J. Reese, Supt. of Production, Mt. Clemens;* (5) *Owen A. McCarthy, Sup't. of Water, Dearborn;* (6) *R. W. Navarre, Sup't. of Filtr., Marine City.*

Concerning bearings: 35% of the induction motor failures have been due to bearings. Safe temperature limits of bearings—just warm to the hand. Ball bearings may easily be over-greased and will run hot for no more serious reason. Moral, never fill ball bearing housings more than 1/3 to ½ full with lubricant.

Concerning starting equipment: Prevent arcing and pitting by cleaning switches with emery; keep all contact points lubricated with vaseline.

Dealing with transformers, Mr. Schoeninger went into considerable detail concerning proper ventilation and testing of insulating oil at least once yearly. Oil temperature limits 80°C. for air cooled units and 65°C. for water cooled. He explained oil purification by filtering or centrifuging and advocated that at least 5 breakdown tests be made on reclaimed or new oil before adding to transformers.

In reply to questions, Mr. Schoeninger said that the only true method of determining when transformer oil should be removed was to sample and test, renewing when breakdown came at 17,000 to 18,000 volts. In the absence of check tests, oil in units up to 100 KVA should be changed every two years for safety. For a test a quart sample can be sent to the laboratory of the power utility. He explained that the only function of the oil was that of cooling medium with high insulating characteristics.

"Special Media" by DR. W. L. MALLMAN, Michigan State College, East Lansing, Mich.

Dr. Mallman described the evolution of a new liquid media in the Michigan State College Laboratories, designed to eleminate in a single tube operation gas producing organisms other than the true E. Coli. The improved media (Triptose Broth), now undergoing field demonstration and test in various plants, contains 2% triptose, 0.5% lactose, 0.5% NaCl and Sodium Laural Sulphate (1 to 100,000) as the inhibitor. Results indicated the improved media highly satisfactory on filtered waters for reducing false presumptive tests, while it also speeds up slow lactose fermenters. To date only in one raw water had the results been inconsistent, the score on filtered waters being 100% consistent with the more laborious and time taking procedures now constituting "Standard Methods of Water Analysis."

Irving Dahljelm, Sup't. Filtr., Highland Park; Alfred Eckert, Director Public Wks., Saginaw (from Sup't. of Filtration he went to the top); Claud R. Erickson, Mech. Engr., Dep't. Utilities, Lansing (his baby—Lansing's new Softening Plant)

Dr. Mallman added that in sewage treatment attempts were being made to develop media for streptococci which would, if successful, become the index of purification rather than E. Coli. The reasoning behind this suggestion is the fact that sewage contains organisms of greater significance than E. Coli.

H. E. JORDAN paid high compliment to the work of Dr. Mallman, stating that the best pioneering work on bacterial testing had in recent years been coming out of Michigan and would prove of high consideration in the next revision of "Standard Methods of Water and Sewage Analysis."

"Stabilized Water—Hard or Soft" —by F. T. REDMAN, Hall Laboratories, Pittsburgh, Pa.

Mr. Redman's paper recounted the effects of treating water with hexametaphosphates for preventing troublsome depositions of calcium carbonate from softened waters; also, the more recent observations revealing the alleviation of cold water corrosion in mains when 1 to 2 p.p.m. of "Calgon" had been applied continuously to the water. All of this has been covered in digests appearing in recent issues of this magazine (August issue p. 294; October issue p. 395) to which our readers should refer for the interesting story of "Threshold Treatment" with hexametaphosphates. (That new subscribers may not be deprived, due to curtailment of this digest, we will, upon request, send the two issues as long as copies may be available.—Ed.)

In reply to questions, Mr. Redman stated that untreated hard waters to which the treatment is applied will not deposit hard scale in hot water systems, or cooling systems. Although the price of "Calgon" (69% P_2O_5) is 17¼ cts. per pound, dosages employed in municipal plants (1 to 2 p.p.m.) brought "Threshold Treatment" into competition with recarbonation, aside from consideration of benefits which recarbonation could not provide. In recirculating cooling systems 5 p.p.m. had proved effective even on very hard waters.

HARRY McENTEE, Sup't. of Treatment, Ann Arbor, Mich., revealed experiences with "Threshold Treatment" at the Ann Arbor Softening Plant. In conjunction with sludge recirculation a plant effluent of 29 p.p.m. residual hardness had

(1) *Bill Birch (himself) from Chicago and J. J. Wernette, Sup't. of Water, Grand Rapids;* (2) *Steve Georgeff, Sup't., L'Anse, Mich., and R. L. Sensabaugh, Sup't. of Supply, Muskegon;* (3) *Geo. H. Fenkell, Director A.W.W.A. (Detroit) and Harry Jordan, Executive Sec'y.;* (4) *Everett Jones, Simplex Valve & Meter Co., Phila., and Sec'y. M. N. Gerardy of the Section;* (5) *Wm. J. Russell,* Sup't. of Water, Benton Harbor and Harry Potts of Pe'ma. Salt Mfg. Co., Wyandotte. (*Mr. Russell was elected Chairman of the Michigan Conference.)*

(1) *Leadite's Hayes Kuhns (of rubber joint packing fame); Detroit's C. P. McGrath, Sup't. of Distribution; Badger's Earl Smith (Milwaukee); Wm. Coon, Mgr. of Water & Elec. Plants, (Edison Co.), St. Ignace, Mich.;* (2) *Monsanto's Bob Cowing (St. Louis) and J. R. Wade, Traver's City Iron Wks., Grand Rapids;* (3) *Battle Creek's Contingent—City Engr., Mark Chambers, D. A. Grove, C. D. Harvey, W. C. Titler and H. A. Hartung. (Also attending was H. J. Walbridge.)*

remained at 29 p.p.m. to the consumer' taps. Heating to 180°F. had not created any further calcium precipitation from the "Calgonized" water.

Valves and Hydrants

"Valves and Hydrants" by JAMES E. HORNSHAW, Engineer, Water Dept., Detroit, Mich.

Mr. Hornshaw, chairman of the Sectional Committee on Valves and Hydrants, discussed the desirability of standardization of such equipment, inter-changeability of parts; and, above all, dependability and operatability of valves in emergencies. He cited experiences in Detroit with 14 various makes of valves installed in the original system prior to 1899, and the results of purchasing standardized valves in 4 to 12 in. sizes on exact specifications since 1899. With only 4,900 of the original 14 different makes remaining in a total of 29,800 gate valves in the Detroit system today, the value of standardization in respect to maintenance and replacements needed no further stressing.

In respect to competitive bidding in order to keep costs on a satisfactory basis it was fortunate for cities that a sufficient number of manufacturers now supplied adequately improved valves. Therefore to standardize on one particular design would be needless and an unwise practice. However, it was possible to write specifications requiring higher grade materials than ordinarily supplied in the lowest cost products. At but little added cost, this step was advocated.

In maintenance, one of the chief sources of difficulty had been the stuffing box. Present day improved design and some study in purchase of packings had eliminated most of the troubles, especially in connection with valves in road-boxes. In regard to masonry road-boxes the desirability of leaving an annular space around the pipe, entering and leaving, had materially reduced damage from road shock.

Concerning fire hydrants, a high degree of standardization was even more important than in the case of valves; and even warranted limiting installations to a single design of a reliable manufacturer. In respect to hydrant maintenance, the report called attention to the destructive effects of drawing small amounts of water through hydrant valves, which are barely cracked for the purpose. Instead, a gasketed cap with nipple and small control valve should be attached to the hose connection and the hydrant valve opened full in every use. Damaging valve chatter, and destructive water hammer from sudden closing, had thus been eliminated by requiring miscellaneous hydrant users to employ the cap.

The report directed attention to the tentative revised "A.W.W.A. Specifications for Valves and Hydrants," as a highly useful guide in purchasing; particularly so for the smaller towns.

GEORGE H. FENKELL (Detroit), in commenting on the hidden importance of gate valves beneath ground, said that serious mistakes had been made in considering comparative initial costs instead of comparative long term costs—in short, the service life of valve parts and dependability on these important units when really needed. To his mind, valves should be of a construction to insure a life at least equal to that of the distribution system. They should be of design and materials insuring their freedom from corrosion blockage and stem failure, throughout their life. If it cost more in the beginning, let it be thus, and charge off the added cost over the long span of service to be anticipated with reasonable assurance. In the end, inferior valves were the really costly ones, only one failure in an emergency being the true measuring stick of value vs. first cost.

(Those with an operator's background understood the wisdom underlying Mr. Fenkell's reasoning, which is born of experience and a look back at 'what might have been." —Ed.)

Cathodic Protection

"Cathodic Protection for Water Works Structures" by W. D. LOREAUX, Sup't. of Water Works, Dundee, Mich.

Mr. Loreaux in a most effective and clearly understandable manner, reviewed the underlying principles of corrosion of iron and steel and the reversal of the electrolytic effects procured by reversing the flow of galvanic current naturally resulting in underground and under water corrosion. The process longer established in the gas and oil fields than in water supply practice, known as "Cathodic Protection", involves the production of direct current by small generating sets or the rectification of alternating current to direct current. The latter is in turn sent from ground or water *into* the iron or steel, to stop the minor current flow *away* from the surface which takes with it metal in solution and leaves pits. (For further details see WATER WORKS AND SEWERAGE for May, 1939, p. 195, Reference & Data Section; also August, 1938, p. 783—"The A.B.C.'s of Cathodic Protection".)

Mr. Loreaux pointed out the fact that keeping tank interiors and filter wash troughs painted was difficult and required rush work, under pressure as a rule. Annual cost for painting figured about 3 cents per square foot, He then described two systems now available for Cathodic tank protection, and presented some of the details covering the installations at Dundee for tank and wash trough protection. Concerning performance and costs, he reported the Dundee

(1) *N. B. Green, Detroit Chemical Wks. and Larry Lingnor,* WATER WORKS AND SEWERAGE, *Chicago;* (2) *The "Three Carboneers"—Cliff's-Dow Co.'s R. W. Rowley (Marquette); Norit's Van Reenan (N. Y. City), and Nuchar's H. A. Moffett (Detroit);* (3) *Harry McEntee, Sup't. Treatment Plant, Ann Arbor, and G. H. Layne, Sup't. Water Dep't., Trenton.*

(1) *H. Schumann, Detroit Chemical Co., and Harry Ward, Sup't. of Filt'r., Wyandotte;* (2) *J. F. Rubbo, Sup't. of Filt'r. and A. Kovochich, Plant Operator, Iron Mountain;* (3) *W. J. Van Reenan, American Norit Carbon Co., N. Y. C., and Louis B. Harrison, Sup't. of Filtration, Bay City;* (4) *J. M. Shearer, Chemist, Consumers Power Co. (Cadillac) and D. R. Stillson, Chemist, South Haven;* (5) *M. H. Berns, Metallurgist, and J. W. Courtney, Electro Refractories Co., Buffalo, N. Y.*

installation for a 50,000 gal. tank had cost $250 complete. The current cost now averaged $1.80 per month, with current at 5 cts. per KWH. The cost had been gradually decreasing during the 8 months as the coating (apparently calcium carbonate deposited on the steel surface by the current) was becoming heavier—namely 2.3 KWH dropping gradually to 1.2 KWH per 24 hours.

Mr. Loreaux referred to the installation of a slightly different system at Monroe, Mich., involving carbon electrodes as against stainless steel; also to installations at Dayton, Ohio, two at Indianapolis, Ind. (2 m.g. tanks), and the largest (6 m.g. ground tank) at Milwaukee. So far, concluded Mr. Loreaux, Cathodic protection seemed to be the answer to the water operator's prayer, but only time would tell. If a real success, many of the water works man's greatest troubles would be over—namely, how to apply protection without discontinuity of service, and also elimination of the most costly sort of hurried work under pressure.

This, the most discussed paper of any presented, brought forth many questions in which the following was developed: (1) Current consumption would vary in proportion to the metal surface exposed, plus the conductivity (mineral content) of the water and length of travel from the suspended electrode to the tank surface. (2) Cathodic protection would cost but little in current used if the original protective coating failed only in a few spots, which would quickly be healed with minor current consumption and preclude corrosion spreading further under the coating, as it normally does. Therefore, there was a balance between initial coating cost and cathodic protection to preclude the need for further coating below the water line. The problem zone would be that above the mean water line, indicating the value of maintaining a fairly constant water level for most effective protection. (3) As the calcium plating progressed the rate of build up would apparently diminish, eventually insulating completely and stopping further deposition automatically. This reasoning explained the gradually decreasing current consumption experienced with mineralized waters, such as at Dundee.

EARL E. NORMAN, Sup't. of Utilities, Kalamazoo, reported that cathodic protection had appealed so strongly to him that Kalamazoo was trying out the system on two tanks—one of 750,000 gal. capacity and another of 350,000 gal. capacity.

The New Softening Plant of Lansing

The afternoon of the closing day was given over to an inspection of Lansing's New Softening Plant now under construction. The closing paper on the program was that describing the plant, presented by Otto C. Eckert, General Manager, Water and Electricity, Lansing.

The new Lansing plant, a W.P.A. project, designed by Alvord, Burdick and Howson of Chicago, will have a capacity of 30 mgd., treating the present corrosive well supply with an average hardness of 464 ppm., and 40 ppm. Co_2, 6 ppm. oxygen and 538 total solids. The plant is located in the city near the center of the system.

Treatment will consist of aeration over perforated splash plates, removing 65% of the CO_2. Automatic chemical feed is followed by flash mix and thereafter slow speed Dorr Flocculators. Recarbonation (coke burning) is provided in 3 stages—the first between the primary and secondary settling beyond the flocculators, the second at the entrance to the filters, the third to the filtered water to produce a pH value just short of that creating a corrosive water. The secondary settling basins are located beneath the flocculators and filters. Sludge is to be removed continuously and pumped to disposal ponds remote from the plant. Filter beds have 22″ of sand of 0.45 to 0.50 mm. size and 1.25 coefficient.

Chemicals will be handled by a pneumatic conveyor system and the entire plant will be essentially automatic in its operation, producing an effluent of 85 total hardness, alkalinity of 35 to 40 and pH of 8.0 to 8.5. At 10 mgd. rates chemicals to be handled and fed will be 15 tons of burned lime and 5 tons of soda ash. Tubes of copper bring samples from points throughout the plant into the laboratory. For operating flexibility the plant has been constructed in two units.

Conference Meeting

Following the plant inspection the Michigan Operators Conference held its business meeting and to hear Secretary Faust recount water supply developments of the year in Michigan. Now, reported Mr. Faust, every community of 1000 or more in Michigan has a public water supply and almost one-third of all public supplies are to be found in communities of less than 1000. Six new softening plants had been completed during this year, but 256 public supplies in Michigan could very well stand softening. The largest project was that of Grand Rapids, now constructing a supply line of 36″ Lock-Joint Cement pipe 35 miles to Lake Michigan, for a softer and more dependable supply. Also the construction of a 40 mg. underground storage reservoir on the distribution system.

Mr. Faust reported that 127 water plant operators had now passed examinations for certification. The Certification Bill (water and sewage) failed to pass the legislature because of jeopardy to the civil service status of employees becoming licensed. It is to be modified and re-submitted. Two cases of back-syphonage and resultant epidemics were cited, the trouble having been corrected by installing larger mains supplying the institutional buildings involved.

The meeting closed with a vote to repeat the joint meeting in 1940, but to hold at least one session of the Operators' Conference separate from the Section sessions for the purpose of more effectively thrashing out treatment problems.

(Adjournment)

POROUS PLATE FILTER BOTTOM

Eliminates Gravel Bed at Larchmont, N. Y.

By HENRY T. HOTCHKISS, JR.
Supervising Chemist
LARCHMONT, N. Y.

IT IS not necessary to search very far into the literature to turn up items relating to the elimination of filter bed troubles. For examples, at and near the sand surface, there were reported the introduction of such scouring devices as the surface wash system of J. R. Baylis,[1] the subsurface filtering and washing device of I. H. Jewell,[2] the surface "sweep" of C. E. Palmer [3] and other mechanical tools for breaking compacted sand.

In the deeper layers various expedients have been tried in order to maintain gravel strata in place. Screens at the sand-gravel interface, as in the original Cincinnati construction, or the division of the filter box into compartments by screens to prevent lateral displacement have been used. More precise gradation and placement of gravel has been beneficial, while addition of "torpedo" size sand[4] has sometimes aided in stabilizing the zone of final distribution of wash water. This zone is located just beneath the sand. The loss of head due to the gravel has been shown to be nearly all concentrated here.[5] The importance of keeping this stratum in a conventional filter from becoming disrupted is now realized. However, the difficulties experienced and the rebuilding required for correction, indicate that maintaining fluidity of sand during expansion is secured at the hazard of some fluidity in the somewhat coarses underlying media. A recognition of this paradox is reflected in the experiments with cemented gravel,[6] where immobility was secured by bonding the fine gravel as an integral part of the filter bottom around the tile laterals.

It is elementary to state that the two reasons for the use of gravel

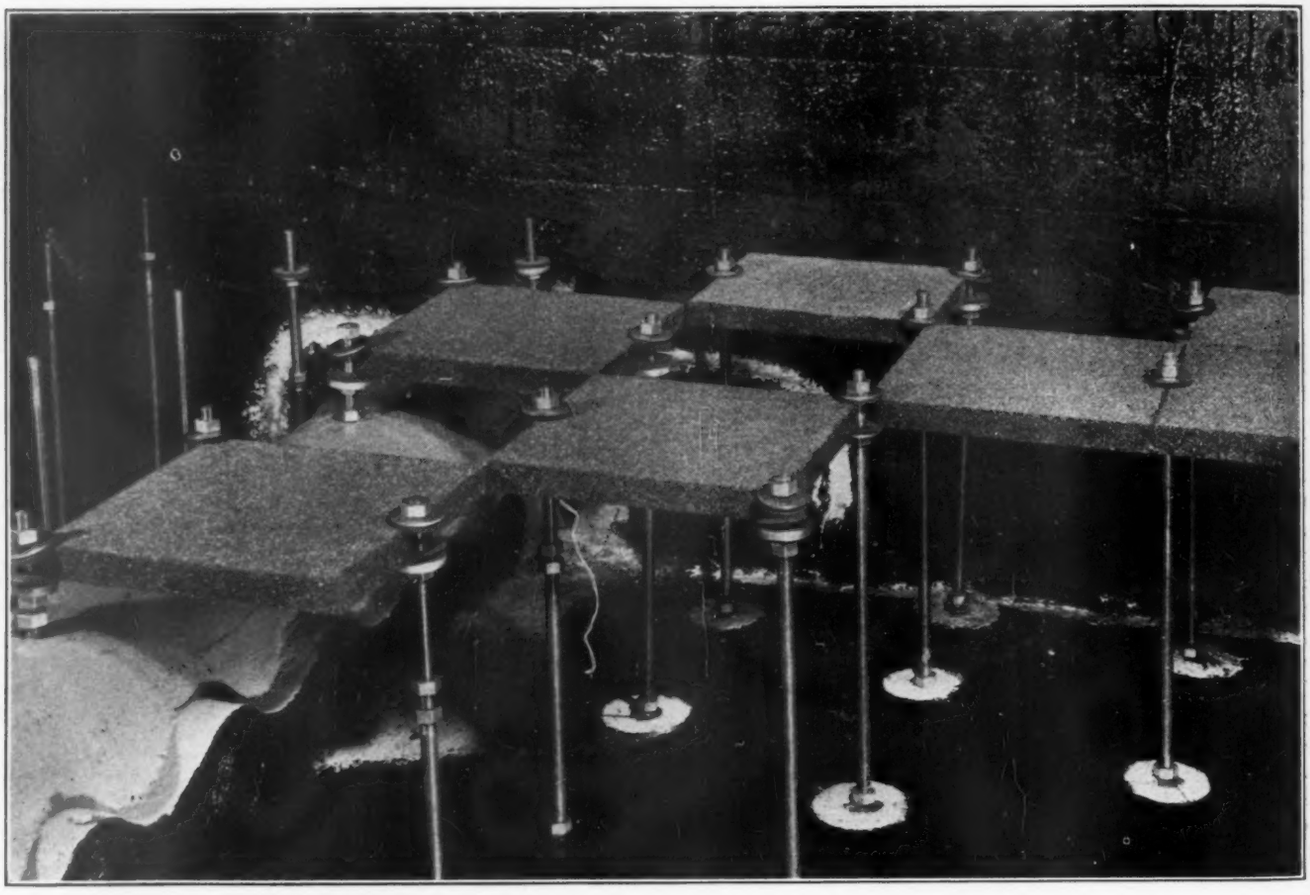


Fig. 1.—Porous Plate Filter Bottom Construction at Larchmont, N. Y.

Note the old manifold on the left, and the method of three point support of the 12x12 inch plates. This scheme reduces the number of "Everdur" studs, washers and nuts required, and makes for easy and exact levelling of all plates as assembly proceeds.

are: first, to support the sand and prevent it from reaching the underdrains; second, to uniformly distribute the wash water to the sand. The important studies made, relating to the gravel layer, have been undertaken to perfect these functions. The distribution of wash water by underdrains or false bottoms is a separate and complex problem. Were it possible to support the sand in a different manner and at the same time provide for uniform wash water characteristics, then the gravel layer could be eliminated. This article relates to one such method which has been brought to a practical state of accomplishment. A filter has been rebuilt. By constructing a false bottom from manufactured porous plates, it has been possible to support the sand bed directly thereon. Nothing has been detracted from the primary purpose of the filter. It is believed that definite advantages have been gained.

Condition of Filters

Since an investigation of the condition of one filter unit was made in 1936 a review of filter design has been made. When the unit was being dismantled some astonishing facts came to light. It was pointed out previously [7] that the sand at the Larchmont plant had become quite uniformly coated with a dense manganese deposit. The origin of this was traced to seasonal increases in the concentration of that element in the raw water. The sand is dark brown,—almost black when wet. Yet, in excavating the sand, an area was reached directly over a portion of the manifold, and at the sand-gravel juncture, where sand and gravel were free of any but the slightest discoloration due to manganese deposition. It would appear that this "lens" of filtration media had been practically idle ever since the plant had been put into operation. Gravel elsewhere was appreciably discolored. Another enlightening discovery was made when the wrought iron laterals were uncovered. Adjacent aggregate had become cemented to the pipes by rust incrustants. These laterals were removed and examined. The pipes had been drilled to give eight half-inch orifices on each lateral. After but eight years of service many of these were completely sealed with products of corrosion,—in one case seven of the eight openings were plugged. There were no orifices provided in the central manifold. After this investigation, it was not hard to account for undesirable sand surface manifestations, such as cracking. Further, it was then understood why such procedures as sand cleaning with caustic and hypochlorite yielded only a superficial benefit.

Here was a problem indeed, having its origin at the depths of the filter box and extending its influence upward to the top of the sand. The reconditioning of the unit on the basis of the original design did not appear promising.

False Bottom Decided Upon

Success with false bottom design,[8] from the days of wooden tubs to present Wheeler bottom and Morse type construction supports the theoretical soundness of equalizing pressure components at any level by utilizing a comparatively large volume of fluid in a single chamber, under conditions tending to minimize velocity differences. Thus a false bottom construction was favored over manifold-lateral design. In the latter, empirical factors govern to a large degree the successful accomplishment of primary wash water distribution. In porous plate installations, a false bottom can readily be secured by mounting the plates on supporting members at a fixed distance above the true bottom of the filter box.

To ensure equal distribution in the washing operation with a false bottom it is fairly obvious that some resistance to flow (with consequent loss of head) is desirable to iron out variations which might arise where a considerable area of bottom is involved. This is taken care of in the manufacture of the plates. For uniform resistance, matched plates—based on permeability tests—may be secured for any installation. At the same time this characteristic is so regulated that filter sand is unable to pass through the interstices of the plates.

Eliminating the Troublesome Gravel

By this simple procedure the gravel is eliminated from the picture and with it all the associated problems of the sand-gravel stratum. It is apparent that with sand alone in the box, the sand surface will reflect the true depth of filter sand at all points,—something which cannot be predicted from surface indications in a conventional filter. This assurance will appeal to any operator or designer. In reconstruction work, the removal of gravel will give ample space for the false bottom; for new plants somewhat shallower boxes can be used, thus saving in concrete and conserving loss of head through the plant.

In order to avoid a major operation in the installation under discussion, the manifold was left in place (see Fig. 1) and lateral baffles were bolted to each side to deflect the wash water issuing from the manifold openings remaining after the laterals were removed. This method was provided to bring water into the chamber under the false bottom.

Fig. 2.—The Completed Porous Plate Bottom

Here again the three point method of bolting is clearly seen, also the neatly poured joints. Twenty-four inches of sand was placed directly on this bottom. Our gravel bed inversion troubles are over.

Early filter units were in many cases designed with fine strainers to act as a screen to keep sand out of the underdrains. No gravel was used. The method was discarded because of clogging and failure of the screens. These cannot be compared to the plates where the entire filter bottom acts as a screen. Based on four-year service of porous plate bottoms F. L. Roe[9] of the Carborundum Co. reports that clogging is not a serious problem. However, provision has been made in the Larchmont installation to clean sand and plates in place when desired. The plates are manufactured of refractory materials highly resistant to chemical action. By installing necessary fittings it is possible to circulate acid or alkaline solutions through the sand and plates. All metal and concrete subject to attack were painted with chemical resistant paint. In mounting the plates, Everdur metal fittings were utilized because of its strength and non-corroding qualities.

Construction Details

For those interested in details of construction the following notes are appended.

The "Everdur" studs were fashioned from ⅝" bars, threaded at both ends. The bottom thread entered bushings 2½" long and 1" diameter, knurled on the outside. These bushings were cemented into holes drilled in the concrete of the original filter box. The studs were locked by hexagonal nuts over the bushings. Baffles of ¼" steel plate were bolted on either side of the manifold and supported by the rows of studs adjacent thereto (see Fig. 1) and held at the proper level by a pair of nuts on each stud. A row of short studs was fastened to the top of manifold after drilling and tapping the cast iron fitting along its center line. A nut and 2" washer 5/32" thick were mounted at the upper end of each stud. Sponge rubber washers 2" in diameter by 3/16" thick, punched from No. 95 commercial grade sheet, were slipped on to provide a cushion for the plates (see Fig. 1). The Norton Company of Worcester, holders of U. S. Patent 2,043,734 covering this method of installation, supplied plates one foot square and an inch thick, and the required number half plates. All plates were supplied with the necessary holes and clearances needed so that they might be slipped into place without further preparation. Above the plates and on the studs followed a rubber washer, then a 2" "Everdur" washer ⅜" thick, and finally a nut. By adjusting the nuts during assembly all the plates were leveled in every direction. Each face of abutting joints was coated with hot, self-healing "bridge" cement just before assembly and finally all plate and wall joints were poured with the same material. These joints were on the average 1/16" wide. Copper piezometer tubes have been provided above and below the plates at three points to study operating characteristics. From the accompanying photographs many of these details are easily seen.

The bottom installation completed (see Fig. 2), sand was recovered by screening out the old gravel and this sand was placed to a depth of two feet directly on the false bottom. This was then soaked in strong hypochlorite solution and the unit after thorough washing was placed back on the line.

After several months of operation the performance of the porous plate bottom leaves nothing to be desired. Wash water distribution yields a level sand surface free from undesirable cracks. It is gratifying to know that the gravel, being absent, will never present another problem to those responsible for performance of the Larchmont filters.

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[1] Water Works and Sewerage, **83**, 197 (1936).
[2] J. Am. Water Wks. Assn., **30**, 817 (1938).
[3] Water Works and Sewerage, **85**, 956 (1938).
[4] C. R. Cox, Bull. 22, Div. of San., N. Y. State H. D. (1939).
[5] T. R. Camp, J. New Eng. Water Wks. Assn., **49**, 1 (1935).
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[7] H. T. Hotchkiss, Water Wks. Eng., **91**, 202 (1938).
[8] See discussion L. V. Carpenter, Water Wks. & Sewerage, **86**, 303 (1939).
[9] Water Wks. and Sewerage, **86**, 303 (1939).

King's Handbook of Hydraulics—3rd Edition
(A Review)

Author: Horace W. King, Prof. of Hydraulic Engineering, University of Michigan.

Publisher: McGraw-Hill Book Co., New York, N. Y. (617 pages in flexible cover, pocket size, 3rd Edition—$4.00.)

Professor King has produced a third edition of his well known "Handbook of Hydraulics", with revisions and additions. Perhaps the most noteworthy additions are the extensions of the two chapters on "Open Channels With Uniform Flow" and "Open Channels With Non-uniform Flow".

After 10 years of wide usage the 3rd edition has been brought to an even higher degree of completeness and usefulness. Amongst the new material added is to be found the treatment of phenomena associated with sudden, as well as gradual, changes in the cross-section of a stream. Formulæ dealing with critical depths, hydraulic jump, translatory waves, accelerated and retarded flow, are developed. Practical applications of these formulæ is helpfully presented also.

This book contains everything commonly needed in the study and solution of hydraulic problems—from the A. B. C.'s to involved computations and tables of data designed to reduce the labor of performing such computations, in drafting specifications and the design of water conveying structures and equipment.

In addition to the chapters dealing with Open Channels, amongst the 11 section headings are the following—Orifices, Gates and Tubes; Weirs; Pipes; Measurement of Water Flow; Units of Hydraulics. In the better than 600 pages of material there are more than 350 tables and diagrams, with explanatory treatment pertaining to their practical applications.

We consider Professor King's Hydraulics a "must" amongst modern hand-books and reference works. —L. H. E.

Is It True Pennsylvania?

Associated Press papers carried this item last month:

Pennsylvania Blocks Ohio River Purification

Pittsburgh, Oct. 18 (A. P.)—Pennsylvania was held up today as the principal stumbling block in the way of an interstate agreement for purification of the Ohio River.

Delegates to a nine-State conference on the Ohio River valley water sanitation compact declared that if this State would cooperate the way would be cleared toward mitigation of serious menace to public health caused by the discharge of sewage into the Ohio and its tributaries.

Indiana, New York, Illinois, West Virginia and Ohio have ratified the pact, with Kentucky, Virginia and Tennessee legislatures expected to act at their next sessions.

We thought that Pennsylvania had at long last really gone "over the top" in an anti-pollution drive. Can the clipping be true, Pennsylvania?

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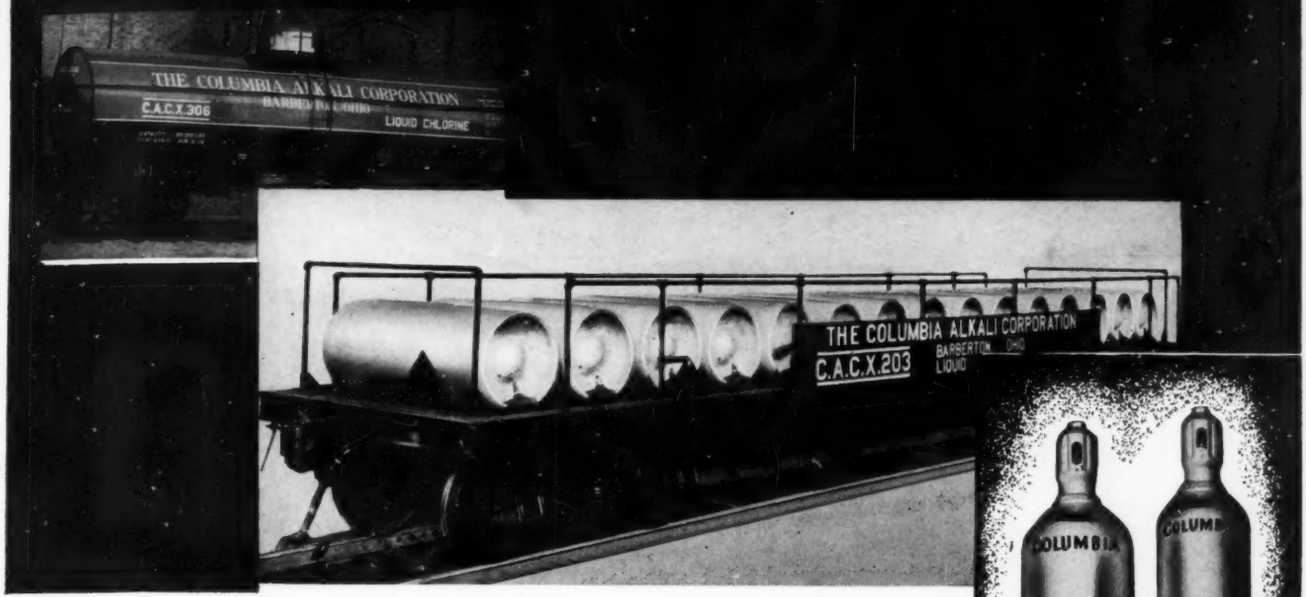

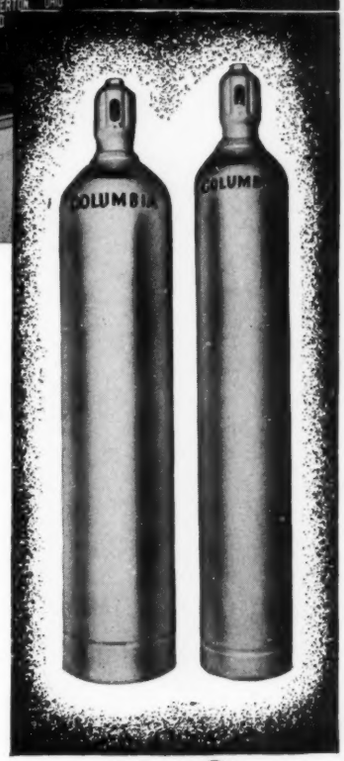

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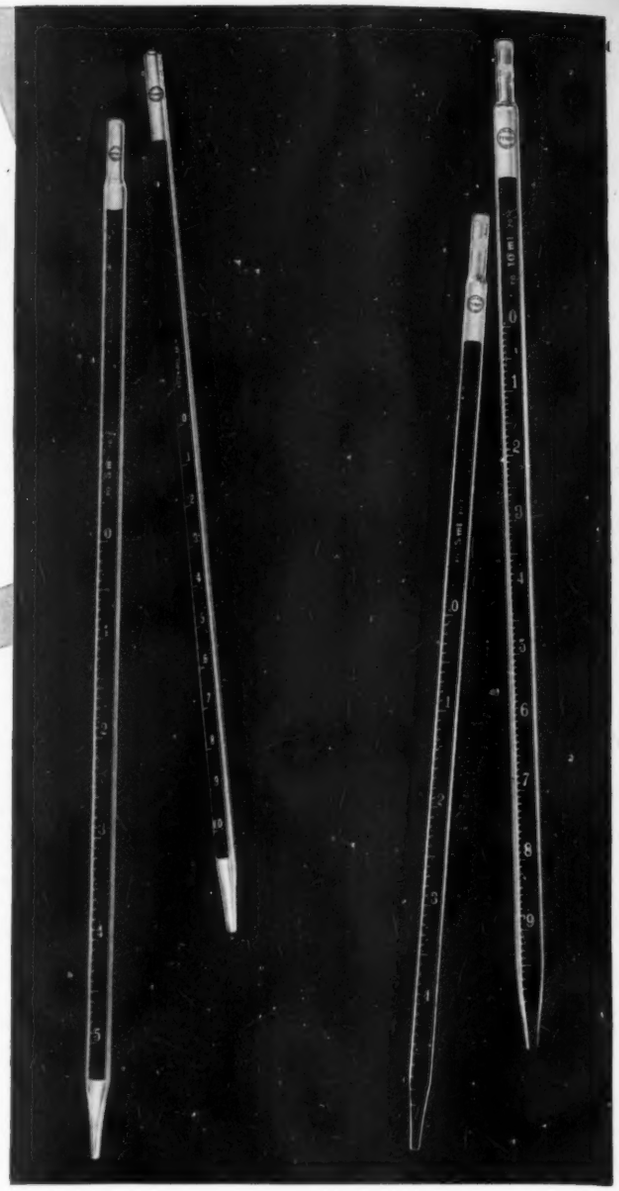

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SIMPLE METHOD FOR CHECKING PUMP EFFICIENCIES*

By H. E. BECKWITH, Distr. Engr.
THE PITOMETER CO.
HARRISBURG, PENNA.

SOME twenty years ago when I first entered the water works field steam driven displacement type pumps were in general use. But in the past twenty years a great change has taken place—particularly in the small and medium sized plants —and today we find the great majority of pumping stations equipped with electrically driven centrifugal pumps,—with an occasional Diesel driven or turbine driven centrifugal installation. That good old slow moving reciprocating pump could always be depended upon to take care of changing pumping loads and varying heads without any great loss in efficiency. But this is decidedly not so with the modern centrifugal pump. This equipment is designed to work under rather rigidly fixed conditions and any appreciable variation from these conditions is accompanied by a falling off in efficiency.

Unfortunately, the non-technical water works operator who got his early practical experience with the old displacement type of pump has not always become sufficiently acquainted with the characteristics of the centrifugal pump. Only too often the only demand made on a centrifugal pump is that it pump water. No attention is paid to the efficiency with which it does its work. In fact, the average water works man is not acquainted with any simple method of determining this efficiency. It is the purpose of this article to point out the conditions which may be expected to cause low operating efficiency, and to outline a simple method for testing the wire to water efficiency which gives results as close as is necessary in practical water works operation.

The Basic Principles of the Centrifugal

As a youngster I used to tie a chestnut on the end of a string and whirl it around my head until I had imparted to it the force necessary to take it flying through the air at high speed. You did it too. The principle

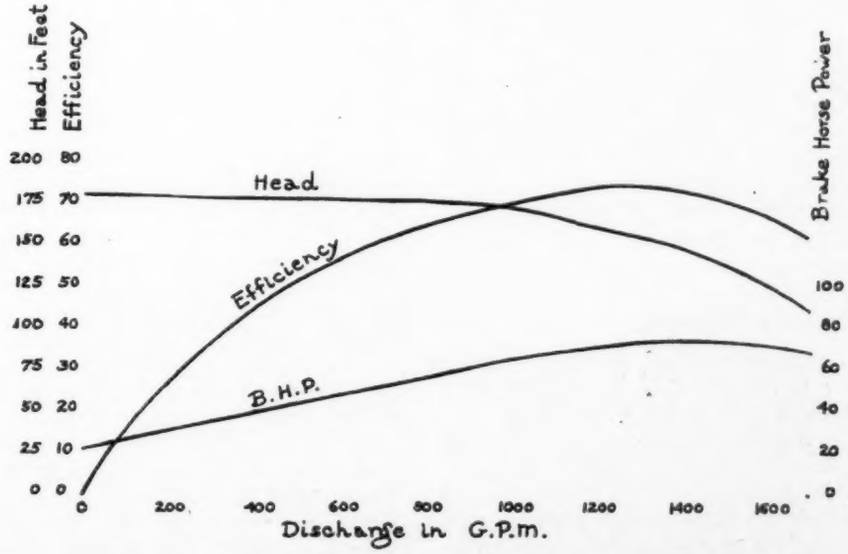
The Author

of building up velocity in that chestnut by whirling it about the head is the same principle which is used in the design of a centrifugal pump. The water which enters the pump through the suction inlet is seized by the rotating vanes of the impeller and spun until it is rotating at terrific velocity. Since pressure and not velocity is desired, the pump is so designed that by gradually slowing down this velocity in the casing of the pump, the energy stored up in this rapidly moving water is almost entirely changed to pressure. The speed of the chestnut rests upon two factors—the length of the string and the number of revolutions made within a specified period of time. The speed, and hence the resulting pressure, imparted to water by a centrifugal pump also rests upon the same two factors—the diameter of the impeller and the number of revolutions per minute which the impeller makes.

There are, of course, practical limits to both the speed and the diameter so that it is not always possible to secure the full desired pressure with one pump. If not, the water is passed through two or more pumps in series, and each pump raises the pressure part of the total desired amount. Sometimes these two or more pumps are built in one pump case, in which instance each pump is called a "stage". As electrically driven centrifugal pumps operate at fixed speeds, there is always one head under which a pump will operate most efficiently. Right here it will not hurt to repeat that any material deviation from this condition will result in decreased efficiency.

Centrifugal Pump Performance Curves

At this point I want to introduce a typical centrifugal pump curve which we will use for illustration during this discussion. Similar



An Example of Typical Performance Curves for Centrifugal Pumps
Various designs show individual characteristics in respect to the curves produced.

*A paper presented before the Penna. Water Operators Association at State College, Pa.

curves are available from the manufacturer for all medium sized and large pumps. On small pumps it is not customary to furnish such performance curves.

It will be noted from an inspection of the specimen curve that the greatest efficiency for this particular pump (about 75%) is secured when the head is about 155 ft. and the discharge rate is about 1,300 G.P.M. You will also note that as the head is materially increased or decreased from the optimum head there is a large change in the pumping rate and a considerable drop in efficiency. A great deal has been done in the effort to widen out the "peak" of the efficiency curve into a "plateau" so as to give high efficiencies under a wider range of operating conditions. Considerable progress has been made in this direction.

The Important Aspects of Friction Head

Let us see what happens when we forget to include friction loss when figuring the total head against which the pump must operate. If we have figured on the pump whose curve we have, and if we are pumping through two miles of 16" main, the friction loss will add about 18 ft. to the pumping head—making it 173 ft. At this head (see curves) the pumping rate will drop to 1,000 G.P.M. and the efficiency to 70%. Furthermore, the pump is operating on a very critical part of the curve where a slight increase in pumping head—caused by tuberculation in the main or by any other reason—would incur a precipitate drop in both the efficiency and the pumping rate. I have known of such cases—though not often. It also illustrates what can happen to a pump after installation when the pumping head has been increased above the head for which it was designed. As it is the nature of unlined iron and steel mains to tuberculate with a constantly rising friction loss this is an important consideration.

Let us illustrate this in another way.

Selecting a Pump

Suppose that we are in the market for a 1,000 G.P.M. pump operating against a total head of 173 ft., and the pump whose curve we have been using has been submitted for consideration. (And it might be.) I would not consider this pump a good "buy" to operate under these conditions. In the first place it will be noted that the efficiency of 70% is much below the maximum efficiency of 75%. But even more important, perhaps, is the fact that the pump at 173 ft. head is operating under critical head conditions. An increase of only about 8 ft. or less than 5% in the pumping head would bring the head to the maximum which the pump can create—in other words to the "cut off" point. This means that an increase in the head of only 8 ft. (about 3½ pounds) would decrease the pumping rate from 1,000 G.P.M. to zero G.P.M. Moreover an increase of only 3 ft. in head would cause a drop of 200 G.P.M. in the pumping rate. On the other hand, when we are working in the most efficient range of the pump a change of 3 ft. in the head would only cause a variation of 30 to 40 G.P.M. in the pumping rate. And the efficiency is practically unaffected.

It follows, therefore, that one should buy a pump within the range where the efficiency curve is as *flat* as possible and the head curve is as *steep* as possible. In this connection a word of warning may not be amiss. By making the vertical scale of the curve less than is customary, a much flatter *appearing* efficiency curve can be secured. So in comparing the performance curves of pumps be sure that they are plotted on comparable scales. I have known curves with reduced vertical scales to be submitted where I felt sure that the scale was deliberately reduced for the purpose of deception.

Sometimes to Save Is to Lose

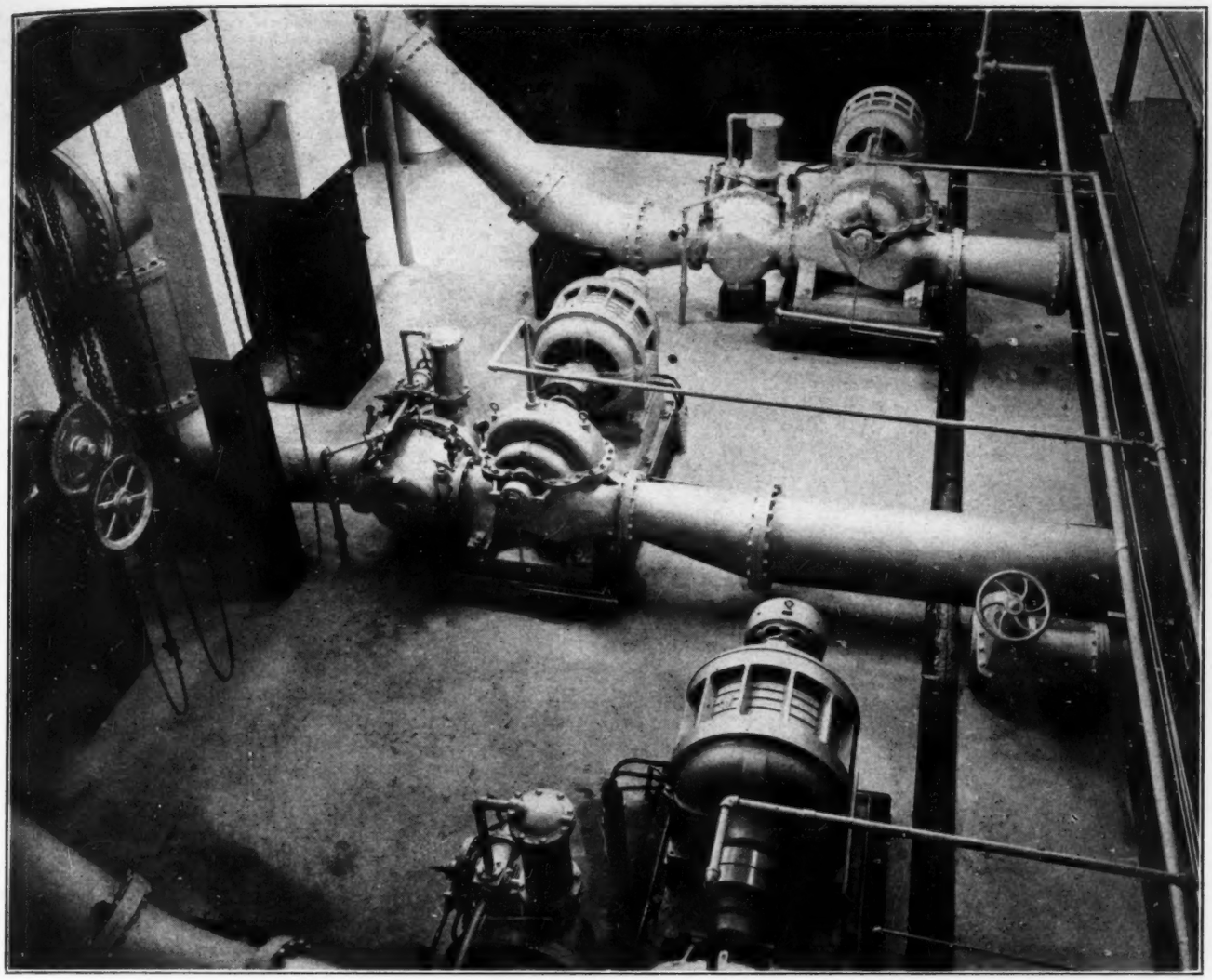
Only too often in the revamping of a plant, efforts are made to reuse as much of the old equipment as possible. It may be assumed that if the old pump will handle 1,300 G.P.M. against 155 feet of head it should have less trouble pumping the same amount from the river to the settling basin against a head of only forty or fifty feet. This is so. In fact, if we will look at the curve we will find it will pump much more than 1,300 G.P.M. at the lower head. The curve does not go out that far, but it goes far enough to show what would happen—not only to the pumping rate but to the efficiency as well. The pumping rate goes up but the efficiency goes down—yes, way down. Reducing the head has a tendency to cause a pump to run away much as an automobile would run away down hill when the going becomes easier if the throttle were not closed to compensate for the decreased demand for power. This running away of the pump sometimes overloads the motor so that it runs hot. To prevent this, the head is often artificially increased by closing a valve on the outlet side of the pump. This decreases the load on the motor and brings the pumping rate back to normal. But it burns up a great deal of power needlessly as the closed valve destroys part of the head generated by the pump and only part of the work actually performed is effective. I have known of installations such as this where the installation of a new pump saved in one year more than enough power to pay the entire cost of the new pump and motor and completely depreciate the old unit replaced.

But it is not always necessary to buy a new pump just because the head has been reduced. If we will get back to that chestnut on the string we will find that we can reduce the speed of the chestnut by reducing the length of the string while at the same time keeping the number of revolutions constant. In the same manner, we can cut down the pressure generated by a constant speed centrifugal pump by reducing the diameter of the runner. If the reduction in head is moderate, the manufacturer can advise you how much will have to be machined off the outside of the present impeller so that it will pump efficiently, or at a slight expense he will furnish a new impeller for the changed conditions.

It is sometimes, but not always, possible to secure a larger impeller to efficiently handle increased heads, but in this case the motor is likely to be overloaded.

Another way to increase the speed of that chestnut would be to keep the length of the string constant and to increase the number of revolutions. It follows that if we increase the revolutions of any centrifugal pump we will increase the head which that pump will generate. This explains why a certain pump tested last fall gave a wire to water efficiency of only 40%. This pump was designed for use with a gasoline motor and to operate under the existing head conditions at a speed of 1400 RPM. Eventually electric power became available and the pump was connected to an electric motor and the speed increased to 1,800 RPM. This, of course, increased the head generated by the pump itself, with the result that it was working against only a portion of its design head and the efficiency was, consequently, very low.

A somewhat similar condition was found several years ago when a 5 MGD installation designed to



Replacement Pumps at Charlotte, N. C.

Substituted for less efficient pumps, to save the city much money.—See text.

work against a head of 100 pounds was found to have been connected in series to a 5 MGD pump designed to pump against 50 pounds pressure. This gave an installation with a design head of 150 pounds, but the actual head was still about 100 pounds. The output was thereby increased to approximately 6 MGD but the efficiency decreased to the point where it was only slightly above 40%. New and properly designed equipment brought the wire to water efficiency up to about 75%.

It can be readily seen from the above that the chances of buying a suitable pump from the junk man are just about nil. It might be "as good as new" for the conditions for which it was designed and yet be absolutely worthless under any other conditions. In fact, it would probably be a most expensive liability. Yet pumps have been bought from junk men.

So far, we have been discussing equipment which has been working under conditions which made it impossible to give a creditable showing. A mere inspection of the conditions and a knowledge of the design limitations would make it evident that satisfactory performance under these conditions could not be secured. However, there are occasions where after installation things happen to properly selected pumps which will cut the efficiency of the equipment. There was, for instance, the time when we found a water snake wrapped around the shaft with the result that the inlet ports were partially cut off and the suction lift increased way beyond the 15 feet maximum for best performance. In another and similar situation blocks of wood were found jammed in the ports. Then there was the time that low efficiency was caused by the blowing of the gasket of a multiple stage pump and the water was short circuiting back from a higher stage to a lower stage. One of our engineers once reported that an efficiency of 20% was caused by the impeller slipping on the shaft.

Two interesting conditions have been found by the author which have no reference to the actual efficiency of the pumps but which were determined as the result of making efficiency tests. In one instance, where the meter through which power was purchased was used to measure the power input, it was found that an apparent low efficiency was caused by this meter being set 20% high. In another instance, a pump was discharging into a closed distribution system. On the basis of the water *actually discharged* into the system over a 24 hour period the pump had an efficiency of only 8%. Had a standpipe or reservoir been floating on this

system, the same amount of water could have been pumped with about one-eighth the amount of power which was actually used.

A Simple Efficiency Test

Enough has been said, I believe, to emphasize the importance of keeping a check upon all centrifugal pumping equipment to be sure that it is working in a satisfactory manner. The writer has worked out a simple method for making these tests which he has been using for some years with satisfactory results. At one foot of head and 100% efficiency of *both pump and motor* it is theoretically possible to raise 318,200 gallons of water the one foot with one KWH. To determine this theoretical value for any other head, simply divide 318,200 by the head involved. [In this connection the accompanying "Table of Theoretical Values for Various Heads" may prove helpful in reducing calculations in pump testing. It was prepared by the writer and is taken from the 1939 Reference and Data Number of WATER WORKS AND SEWERAGE.] For instance, the value at 159 ft. would be $\frac{318{,}200}{159} = 2{,}002$ gallons per KWH. To determine the *wire to water efficiency* of an installation it is only necessary to divide the actual pumpage per KWH by the theoretical value for the pumping head, as determined above. A rough check can be made by dividing the month's pumpage in gallons by the KWH consumed. This gives the gallons actually pumped per KWH.

Table I—Gallons of Water Delivered per Kilowatt Hour Against Various Heads on Theoretical Assumption That Pump and Motor Are 100 Per Cent Efficient

H = head in feet. G = gallons per kilowatt hour

H	G	H	G	H	G	H	G	H	G	H	G	H	G	H	G	H	G	H	G
1	318,200	51	6,240	101	3,151	151	2,108	201	1,583	251	1,268	301	1,058	351	907	401	794	451	706
2	159,100	52	6,120	102	3,120	152	2,094	202	1,575	252	1,263	302	1,054	352	904	402	792	452	704
3	106,100	53	6,005	103	3,090	153	2,080	203	1,567	253	1,258	303	1,051	353	902	403	790	453	703
4	79,560	54	5,894	104	3,060	154	2,067	204	1,560	254	1,253	304	1,047	354	899	404	788	454	701
5	63,650	55	5,786	105	3,031	155	2,053	205	1,552	255	1,248	305	1,044	355	897	405	786	455	700
6	53,040	56	5,683	106	3,002	156	2,040	206	1,545	256	1,243	306	1,040	356	894	406	784	456	698
7	45,460	57	5,583	107	2,974	157	2,027	207	1,537	257	1,239	307	1,037	357	892	407	782	457	697
8	39,780	58	5,487	108	2,947	158	2,014	208	1,530	258	1,234	308	1,033	358	889	408	780	458	695
9	35,360	59	5,394	109	2,920	159	2,002	209	1,523	259	1,229	309	1,030	359	887	409	778	459	694
10	31,830	60	5,304	110	2,893	160	1,989	210	1,516	260	1,224	310	1,027	360	884	410	776	460	692
11	28,930	61	5,217	111	2,867	161	1,977	211	1,508	261	1,220	311	1,024	361	882	411	775	461	691
12	26,520	62	5,133	112	2,842	162	1,965	212	1,501	262	1,215	312	1,020	362	879	412	773	462	689
13	24,480	63	5,051	113	2,816	163	1,952	213	1,494	263	1,211	313	1,017	363	877	413	771	463	687
14	22,730	64	4,972	114	2,794	164	1,940	214	1,487	264	1,206	314	1,014	364	875	414	769	464	686
15	21,220	65	4,896	115	2,766	165	1,929	215	1,480	265	1,202	315	1,011	365	873	415	767	465	685
16	19,890	66	4,822	116	2,744	166	1,917	216	1,474	266	1,197	316	1,007	366	870	416	765	466	683
17	18,720	67	4,750	117	2,720	167	1,906	217	1,467	267	1,193	317	1,004	367	868	417	763	467	682
18	17,680	68	4,680	118	2,697	168	1,894	218	1,460	268	1,188	318	1,001	368	865	418	761	468	680
19	16,750	69	4,611	119	2,674	169	1,883	219	1,453	269	1,184	319	998	369	863	419	760	469	679
20	15,910	70	4,547	120	2,652	170	1,872	220	1,447	270	1,179	320	995	370	860	420	758	470	677
21	15,150	71	4,482	121	2,630	171	1,861	221	1,440	271	1,175	321	992	371	858	421	756	471	676
22	14,470	72	4,420	122	2,609	172	1,851	222	1,434	272	1,170	322	989	372	856	422	754	472	675
23	13,830	73	4,360	123	2,588	173	1,840	223	1,427	273	1,168	323	986	373	854	423	753	473	674
24	13,260	74	4,301	124	2,567	174	1,829	224	1,421	274	1,162	324	982	374	851	424	751	474	672
25	12,730	75	4,243	125	2,546	175	1,819	225	1,414	275	1,158	325	979	375	849	425	749	475	671
26	12,240	76	4,188	126	2,526	176	1,809	226	1,408	276	1,154	326	976	376	847	426	747	476	669
27	11,790	77	4,133	127	2,506	177	1,798	227	1,402	277	1,150	327	973	377	845	427	746	477	668
28	11,370	78	4,080	128	2,486	178	1,788	228	1,396	278	1,146	328	970	378	842	428	744	478	666
29	10,970	79	4,028	129	2,467	179	1,778	229	1,390	279	1,142	329	968	379	840	429	742	479	665
30	10,610	80	3,978	130	2,448	180	1,768	230	1,384	280	1,137	330	965	380	838	430	740	480	663
31	10,270	81	3,929	131	2,429	181	1,758	231	1,378	281	1,133	331	962	381	836	431	739	481	662
32	9,945	82	3,882	132	2,411	182	1,749	232	1,372	282	1,129	332	959	382	833	432	737	482	660
33	9,644	83	3,834	133	2,393	183	1,739	233	1,366	283	1,125	333	956	383	831	433	736	483	659
34	9,360	84	3,789	134	2,375	184	1,729	234	1,360	284	1,121	334	953	384	829	434	734	484	658
35	9,093	85	3,744	135	2,358	185	1,720	235	1,354	285	1,117	335	950	385	827	435	732	485	657
36	8,840	86	3,701	136	2,340	186	1,711	236	1,349	286	1,113	336	947	386	825	436	730	486	655
37	8,601	87	3,658	137	2,323	187	1,702	237	1,343	287	1,109	337	945	387	823	437	729	487	654
38	8,375	88	3,617	138	2,306	188	1,693	238	1,337	288	1,105	338	942	388	820	438	727	488	652
39	8,160	89	3,576	139	2,292	189	1,684	239	1,332	289	1,102	339	939	389	818	439	725	489	651
40	7,956	90	3,536	140	2,274	190	1,675	240	1,326	290	1,098	340	936	390	816	440	723	490	650
41	7,762	91	3,497	141	2,257	191	1,666	241	1,320	291	1,094	341	934	391	814	441	722	491	649
42	7,577	92	3,458	142	2,241	192	1,658	242	1,315	292	1,090	342	931	392	812	442	720	492	647
43	7,401	93	3,422	143	2,225	193	1,649	243	1,310	293	1,087	343	929	393	810	443	719	493	646
44	7,233	94	3,386	144	2,210	194	1,640	244	1,304	294	1,083	344	926	394	807	444	717	494	644
45	7,072	95	3,350	145	2,195	195	1,632	245	1,299	295	1,079	345	923	395	805	445	716	495	643
46	6,916	96	3,315	146	2,180	196	1,624	246	1,294	296	1,075	346	920	396	804	446	714	496	642
47	6,771	97	3,281	147	2,165	197	1,615	247	1,288	297	1,072	347	918	397	802	447	712	497	641
48	6,630	98	3,248	148	2,150	198	1,608	248	1,284	298	1,068	348	915	398	800	448	710	498	639
49	6,493	99	3,215	149	2,136	199	1,600	249	1,278	299	1,065	349	913	399	798	449	709	499	638
50	6,365	100	3,183	150	2,122	200	1,592	250	1,273	300	1,061	350	910	400	796	450	707	500	636

Table for Arriving at Theoretical Values in Respect to Power Requirements in Pumping Operations

(From the 1939 Reference and Data Number of "Water Works and Sewerage.")

Procedure

With the pump running, determine the total head in feet (including suction) against which the pump works. Divide 318,200 gallons by this total head (as shown) to determine the theoretical 100% pumpage per KWH. Next divide the actual gallons per KWH by the theoretical gallons per KWH to secure the wire to water efficiency.

To illustrate:

Assume a monthly pumpage of 32,640,000 gallons and a monthly power consumption of 30,200 KWH. Say the total head noted was 220 ft. Dividing 32,640,000 by 30,200 gives an actual pumpage of 1081 gallons per KWH. Dividing 318,200 by 220 gives a theoretical value of a possible 1,447 gallons per KWH at 100% efficiency.

$\frac{1{,}081 \text{ (observed)}}{1{,}477 \text{ (theoretical)}} = 74.7\%$ overall wire to water efficiency.

A more accurate method of making the tests is to measure the power input for an hour, or some other convenient period of time. During this period measure the output of the pump with any suitable main line meter. Keep a close record also of the discharge pressure and of the suction. The integrations on most electric meters in pumping stations cannot be read closely enough for short tests. However, the power company will furnish the number of watts consumed for each revolution of the disk, and by counting its revolutions for ten or twenty minutes the rate of power input can be closely ascertained. Or the power company may be asked to measure the power by means of special equipment. Where more than one pump is taking power through the master meter at the same time, this latter method is the only feasible one for testing each unit separately.

Securing Total Head

The total head in feet must first be secured. If the pressure gauge reads in pounds, convert to feet by multiplying the pounds of pressure by 2.31, which is the feet of head giving one pound gauge pressure. The suction will probably be expressed in inches of mercury. Convert this to feet of water head by multiplying by 1.13. Also measure the vertical distance between the center of the pressure gauge and the point of suction measurement. The total head then becomes the sum of the following:

Discharge pressure, in feet	
Suction, in feet	
Vertical distance pressure gauge is above point of suction measurement, feet	

Velocity head has been ignored, as it is a small factor for the relatively

high heads which usually exist in water works operation.

If water is delivered to the pump under pressure, then the pump will be working against a head equal to the difference between the discharge pressure and the inlet pressure.

From the data secured during the test, determine the gallons delivered per kilowatt hour. As before, divide this by the theoretical value for the head against which the pump worked. This gives the overall wire to water efficiency of the installation.

As an example, let us assume an installation where we secured the following test data:

There will be variations from these figures depending upon the head and other conditions. Such are submitted only for the purpose of giving something with which to compare the efficiencies of existing installations. This is important, because it will often be found that older equipment may have retained its original efficiency and yet be so inefficient in comparison with modern equipment now available that it is decidedly not economical to keep it in operation. It will be worth while to check the present efficiency of equipment, now more than ten years old, to determine how great a

Power input to motor	90.0 K.W.	
Rate of discharge	51,840 gals. per hr.	
Delivery per KWH	572 gals.	
Pressure	146 lbs.	= 337 ft.
Suction	15 ins.	= 17 ft.
Difference in gauge elevation	1 ft.	= 1 ft.
Total head		355 ft.

Theoretical discharge at 335 ft. head	$\left(\frac{318{,}200}{355}\right)$	= 897 gals.
Overall efficiency	$\left(\frac{572}{897}\right)$	= 64%

Provided a suction gauge is not available, an approximation may be secured by measuring the vertical distance from the level of water in the clear well to the center of the pressure gauge, adding to this measured distance about two feet for loss in bends, etc.

What the Tests Reveal

Having shown the desirability of frequent tests and a simple method for making them, it may now be interesting to discuss what these tests may be expected to show. In the first place, there have been great increases in the attainable efficiencies of centrifugal pumps within the past few years. Those of modern design may be expected to give up to the following overall ("wire to water") efficiencies. It will be noted that the larger the pump the higher the efficiencies:

Capacity G.P.M.	Efficiencies Percent
200	58
400	63
600	68
800	71
1000	73
1500	75
3000	80
5000	82
Over 5000	85

reduction in power consumption can be secured by the substitution of the more efficient modern pumps. You may be surprised. If an old 1000 gpm pump, operating at an efficiency of 57%, is replaced with a new pump giving an overall efficiency of 73% the same amount of water may be pumped with 22% less power. This means that both the demand rate and the power consumption through each step of the existing rate schedule would be decreased 22%. Such a reduction might be enough to pay for the new installation in about one year's time. In order to get the gallons per KWH to be expected at any head, for any efficiency, it is only necessary to determine the theoretical gallons per KWH for that head and then to multiply this theoretical value by the expected efficiency. If the total pumpage in gallons is then divided by this expected pumpage per KWH the power consumption to be anticipated from the new installation will be secured. Similarly it is possible to determine the anticipated demand rate, which is often as important (if not more so) than is the total KWH consumption in determining the power bill.

A Worthy Example

There was published in the March, 1939, issue of WATER WORKS AND SEWERAGE an article by Messrs. Marshall and Rawlins of Charlotte, N. C., which showed graphically how the power costs were drastically cut at the local pumping station by replacing old equipment with new. These power costs, which had been running about $16.00 per million gallons were cut to about $7.50 per million gallons. This cut was the result of two definite and distinct improvements. In the first place the pumping main was paralleled with a new line. This resulted in reducing the former friction loss materially. This single betterment cut the power cost from $16.00 to $12.00 per million. Following this, the not very old but less efficient pumping units were replaced with modern efficient equipment. This investment, which might appear to the average municipal councilman a questionable expenditure, further reduced the pumping cost to $7.50 per million, representing a very notable day in and day out saving.

There are many other plants in this country waiting for managers of Mr. Marshall's foresight to cut operating costs. If there be any doubt that such places exist, or that similar savings have not frequently been made, an examination of our company's reports on pumps we have tested will prove conclusive evidence that they do exist and that unexpectedly large savings are possible.

In conclusion, I wish to thank the Gould Pump Co., the DeLaval Steam Turbine Co., and the Worthington Pump and Machinery Corp. for their help in preparing this article.

Bell and Latham to Continue the Firm of Howard K. Bell

The firm of Howard K. Bell, Consulting Engineer, Lexington, Kentucky, practicing in water works and sewerage utilities, and municipal improvements, will be continued by his associates, Grant S. Bell and James K. Latham, under the present firm name and policies of the late Howard K. Bell.

Mr. Bell, son of the late Howard K., became an associate upon his graduation in 1929 in civil engineering at the University of Kentucky. Mr. Latham, also a University of Kentucky graduate in civil engineering, became an associate in 1937. Except for brief periods, both have been with the firm since 1925.

THE ENSLOW CONTINUOUS STABILITY INDICATOR*

Some Experiences With This Scheme of Streamlining the Marble Test

By ROLAND J. LEVEQUE
Supt. of Filtration
FREDERICKSBURG, VA.

AT THE 1938 meeting of the Virginia Section of A.W.W.A., corrosion problems and treatment were ably presented.

In the discussions which followed, the Langlier Index was explained. It has, however, been rather generally considered that this method of determining the relative corrosivity or degree of calcium carbonate saturation, hence stability of waters is a bit too laborious and technical for use in the average waterworks laboratory.

In commenting on this fact, Mr. Enslow, Editor of WATER WORKS AND SEWERAGE proposed a worthy substitute for the exact chemical analysis and computations involved in Langlier's Index. Mr. Enslow's "Gadget" he humorously dubbed a "Convention Chair" invention, in as much as it had never been put to actual test. He illustrated on the blackboard his idea of a simple and practical device for measuring the "hunger" of water for calcium carbonate, and therefor its corrosivity. It consisted of two vertical tubes connected in series, one filled with ground limestone or powdered chalk and the other filled with marble chips. A small stream of the treated water was to flow through this device continuously, and by simply making an alkalinity and p.H test on the water before and after it had passed through the apparatus, noting the pick-up or decrease, one could tell at a glance whether or not the finished water was in balance as to its calcium carbonate content.

The idea so appealed to this writer, that no time was lost in having one made up. A picture of a "tailor made" Enslow Stability Indicator as first set up in our laboratory is herewith shown.

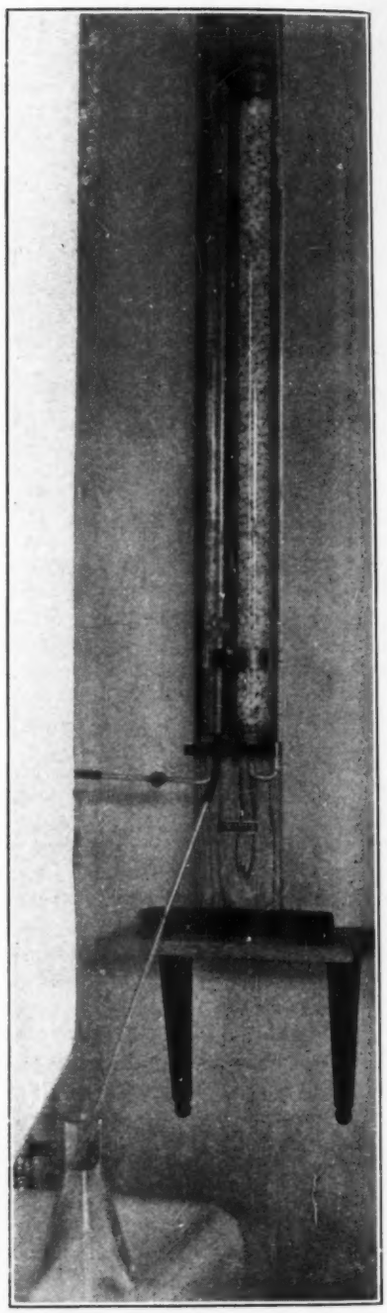
The Author

Size of Calcite Material Important

It will be noticed that both tubes are filled with rather coarse marble chips. In setting up the apparatus, using powdered chalk in the first tube, it was found that this material when wetted, became a thick sludge which offered so much resistance to the small flow desired, that it was practically impossible to pass water up through it. This called for a bit of experimenting, and both tubes were then filled with coarse chips. No trouble was encountered in obtaining the flow through this material, and just a dribble gave a four hour contact period.

This arrangement proved satisfactory at the outset, but as the finer material on the marble chips dissolved or washed off, the efficiency of the indicator was impaired. Checking the indicator effluent by means of the regular marble test, showed a further pick-up in alkalinity, indicating that this material was unsatisfactory unless a longer period could be provided.

The use of powdered chalk in combination with glass wool in the primary tube was then tried, but without much success. The wetted chalk clogged the glass wool and increased the pressure to a point where it cracked the glass tube. A copper tube 3 feet long and 2 inches



The Enslow Stability Indicator in the Fredericksburg Laboratory
(*Performs the marble test while you sleep.*)

*Excerpts from a paper, "Results of New Ideas at Fredericksburg," presented before the 1939 meeting of the Virginia Section of A.W.W.A. by the author.

in diameter was substituted as the primary container. This was filled with successive layers of marble chips and powdered chalk, the idea being to fill the voids in the coarser medium with the finer material. This charge was carried up to within four inches of the top, two inches of torpedo sand then being added. This was topped with a plug of glass wool, to prevent washing of the sand over into the No. 2 tube.

Success

The new set-up was again put into operation and after a sufficient operating period had elapsed to insure reliable sampling, another marble test was made on the indicator effluent. A slight drop in alkalinity after this test showed that the indicator was now yielding a saturated water and providing the correct index.

It might not be amiss to again call attention to the importance of providing a sufficient contact surface and an adequate period, the longer the contact the better. Also, when checking the effluent from the Enslow Indicator by means of the Baylis modification of the Marble Test, it is important that the precipitated chalk be washed to rid it of the slight soluble alkali which may give erroneous results.

And so, of the methods advanced thus far to determine calcium carbonate stability, it would seem that this simple device proposed by Enslow, provides the most dependable and practical means for checking the equilibrium of a finished water and supplying an index useful in controlling anti-corrosion treatment of whatever nature may be employed.

I trust that I will be pardoned for departing from the conventional, in that I am concluding my paper with a bit of "Rocking Chair" poetry, dedicated to this "Convention Chair" invention. I must warn you, however, that in evaluating the merits of my poetry, you should use the Threshold Odor Method and not the "Enslow Index", otherwise you may find yourselves adding lime to verses which so obviously are in need of carbon. The title of the poem is:

"Streamlining the Marble Test"

Corrosion of pipes
by H_2O
Causes waterworks men
No end of woe.

Tests were devised
But these took time,
Before we could discover
If we were short on LIME.

Now waterworks men
No longer tear their hair,
Thanks to this invention
From a "Convention Chair".

Set it up in your lab,
Without trouble it checks
With a little arithmetic
It gives the "Enslow Index."

[Ed. Note:—Ideas come easily. But making them click is the important step in any new development. The author of this article deserves high credit for having made this "Convention Chair Invention" click. The first Indicator constructed made use of calcite coated filter sand, and performed nobly. However, such material is not available in the soft water areas and the use of some forms of fine grained or pulverized calcite, after the manner developed by M. Leveque, provides the practical solution. In expressing our appreciation, we will be but joining the many operators who are to benefit therefrom.—L. H. E.]

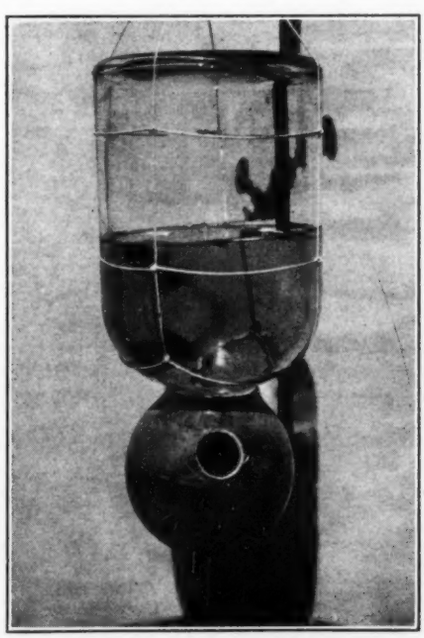
An Emergency Solution Feeder Born of Experience With Needles and Nipples

Dear Bill:

Did you ever get in a "tight" for a small solution feeder when all the barrel and tube stores were closed? I did a while back and the only source of supply was a semi-modern drug store (if it had been completely modern they would have had the necessary line of hardware no doubt). Well, I managed to get a glass jug and a rubber ball about five inches in diameter. I'm sending you a picture of the result but maybe a little explanation wouldn't hurt. It really isn't an inverted atom smasher like you thought at first.

I cut a hole in the rubber ball slightly smaller than the large part of the jug neck near the body of the jug, then I cut another hole about one inch in diameter along side of the first. It was easy to shove the neck of the jug down through the first hole in the rubber ball even though it was a snug fit. Now I had my constant head provided for and I know you see why, because I'm sure your dad watered his chickens with a "rig" something like this, same as my dad did.

Well, let's see, I didn't tell you about getting the solution out of the ball did I? Did your wife ever wake you up in the middle of the night and make you stumble out to the kitchen and heat a needle to poke a new hole in the nipple of the baby's bottle. Uh huh, I always felt like I was going to "cash in" then and there, but never expected to "cash in" on the experience years later. Remember how when the needle got too hot and was left stuck in the rubber too long the bottle nearly drowned the family "pride and joy" (but he got it empty faster, which seemed to have its advantages at the time). It works the same way with this feeder, too. Fact is, when I come to think of it, about the only difference in the two "feeders" is in size, quietness during operation, and maybe constant head. Oh, yes, and there's one other difference; you don't have to take the "nipple" off to fill this chemical feeder.



The "G. R. P." Solution Feeder
Note the small stream from the hole in the center bottom of the "perispherical" constant head reservoir.

Now, Bill, I hope you don't get into any emergencies dire enough to make you have to use such a feeder (the one with the rubber ball) right away, but when and if you do, it works.

Yours 'til then,

"Gib."

[Gilbert R. Frith, of the Georgia State Dept. of Health, was the author of this "Dear Bill" letter. To add that he was formerly a "floor-walker" is giving away no secrets.—Ed.]

ON WATCHING YOUR CASH REGISTER

An Evaluation of the Economic Limits of Meter Maintenance

*Part 3**

By D. R. TAYLOR
Plant Supt., Water Department
ROANOKE, VIRGINIA

The Author

This is the concluding installment of Mr. Taylor's three part article, presenting a study of economic limits of meter maintenance and relating metering practices of the Roanoke Water Department, based on observations and findings from such studies.

This installment deals with observations and practices in connection with maintenance of large meters, wherein a far greater latitude in respect to expense of maintenance can be adequately justified.—Editor.

NOW, may we discuss briefly the matter of large meters. In our case we classify as large meters every type from 1½ inches to 8 inches in size. Seven years ago we inaugurated what we think is a comprehensive maintenance plan for all large meters. We have divided such meters into three classes, for our own particular convenience.

1. Disc meters from 1½ inches to 2 inches.

2. Compound meters from 1½ inches to 6 inches.

3. Fire service meters from 3 inches to 8 inches. We have in our system 175 large meters under the above classifications.

Simultaneously with the inauguration of a system of field maintenance for our large meters we began the installation of by-passes on every large meter installation where it was thought desirable and practicable. The size of the by-pass in question was determined by the customers' requests, but more particularly his requirements, and convenience. We began testing all of these meters with the use of a 2 inch disc meter. We soon found that this size and type of meter did not meet all requirements, so we tried a 2-inch current meter for a time. However, this also did not meet our requirements, so we purchased from one of the meter manufacturers a 3-inch aluminum current-type meter, with which we constructed a highly useful portable meter testing rig as shown in the accompanying photograph.

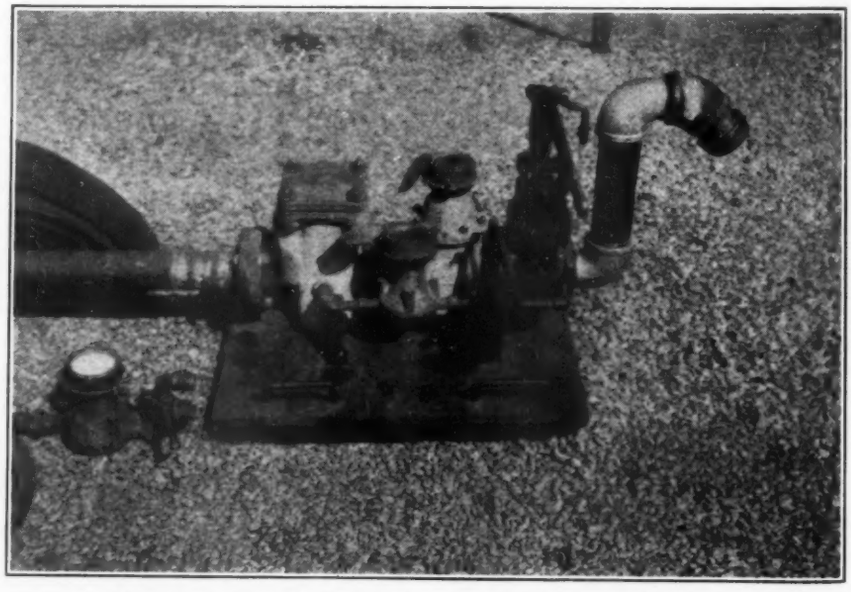
This testing rig has a capacity of 400 g.p.m., which is more than ample to open the "high side" of our 8 inch fire service meters. It also includes a ¾ inch test meter for the small rates.

All of our large disc meters are removed and brought to the shop for tests and reconditioning every three years. This time limit has been found by the "cut and try" method, explained in earlier installments, to be the most economical. Whenever there is a marked decrease in registration prior to the end of the three-year-period, they are of course removed for test immediately.

Our compound and fire service meters are reconditioned and tested *in the field* every year, unless indication of some irregularity requires more frequent tests.

Monthly Revenue Records Watched

A monthly record of our revenue derived from large meters is compiled immediately following each



Meter Testing Rig for Field Testing of Large Meters.

*The two previous installments of this article are to be found in the September and October issues.

EXHIBIT 21
MONTHLY RECORD OF LARGE METERS

Meter No.	Column 1 Address	2 Folio No.	3 Size and Type	4 Date Repaired	5 Revenue 1938 May	5 Revenue 1938 June	5 Revenue 1938 July	6 Revenue 1937 June	6 Revenue 1937 July	7 Comparison this month with that of last year June	7 Comparison this month with that of last year July	8 Comparison this month with last month June	8 Comparison this month with last month July
1.	21 Elm Ave.	54-16	2" disc	6- 1-36	28.60	30.40	34.00	28.40	35.00	2.00	1.00	1.80	3.60
2.	1432—10th St.	54-18	6" Comp	6- 3-38	125.00	130.40	100.80	120.00	140.20	10.40	39.40	5.40	29.60
3.	340 West Ave.	54-19	3" Comp	6- 3-38	98.00	96.00	100.10	94.00	98.00	2.00	2.10	2.00	4.10
4.	414—3d St.	54-20	6" Det	6- 4-38	8.30	8.30	8.30	8.30	8.30	.00	.00	.00	.00
5.	6 High Ave.	54-40	6" Pro	6- 4-38	8.30	8.30	8.30	8.30	8.30	.00	.00	.00	.00
6.	78 Broad Ave.	54-51	1½" disc	3- 5-36	42.80	44.00	50.40	42.00	48.40	2.00	2.00	1.20	6.40
7.	142 Linden Ave.	54-52	2" disc	4- 2-36	34.20	46.00	48.00	44.20	40.00	1.80	8.00	11.80	2.00
8.	28 Jones Ave.	54-60	4" Comp	6- 7-38	76.85	80.20	78.00	75.00	66.00	5.20	12.00	3.35	2.20
9.	748—3d St.	55-8	2" disc	4- 5-36	28.90	35.10	32.40	30.00	33.00	5.10	.60	6.20	2.70
10.	438—2d St.	55-10	4" Det	7- 8-38	6.30	6.30	6.30	6.30	6.30	.00	.00	.00	.00
11.	96—1st St.	55-11	4" Comp	7- 9-38	76.30	85.20	86.20	83.00	80.00	2.20	6.20	8.90	1.00
12.	110—4th St.	55-12	8" Pro	7- 9-38	9.30	9.30	9.30	9.30	9.30	.00	.00	.00	.00
13.	1418 Ash Ave.	55-14	1½" disc	4- 8-36	22.40	20.00	28.00	16.00	26.00	4.00	2.00	2.40	8.00
14.	542 Oak Ave.	55-15	6" Comp	7-10-38	840.20	880.00	870.00	860.00	840.00	20.00	30.00	39.80	10.00
15.	618—14th St.	55-19	2" Comp	7-10-38	48.20	50.20	52.00	50.00	48.00	.20	4.00	2.00	1.80
								Total		54.90	25.30	76.05	17.60
								Total to date			80.20		

monthly billing period in the manner as shown in exhibit 21. All large meters are read monthly, while all small meters are read quarterly, except those from which the revenue derived averages more than $5 per month, in which case small meters in this classification are also read monthly.

This record shows the address, folio number, size and type, date last repaired and tested, the monthly revenue for the present year and that of the prior year. Column 7 shows the net increase or decrease, as revealed by comparing the revenue for the month in question with the same month of the prior year. Column 8 shows the same comparison between any month with the immediate prior month.

All increases are shown in black and decreases in red; therefore any decrease is easily and quickly spotted, and the meter in question is given immediate attention.

In figure 21 we have underlined those amounts that would appear in red on our records, and while we have not made a direct copy of our records the subject-matter shown is analogous.

At the bottom of figure 21 opposite "total" is shown the difference between the totals of the increases and decreases in the column in question which is the total increase or decrease as shown by all of the large meters for the month in question. The "total to date" is obtained by adding or subtracting, as the case may be, all of the monthly totals up to and including the month in question, which shows the total increase or decrease for that portion of the year represented by the number of months in question. For the sake of convenience we make up these records for the first six months of the year on one group of sheets and for the second six months on another group of sheets, carrying the "total to date" forward.

Results of Systematic Checking

The first year that we adopted a systematic plan of maintaining and testing large meters there was reflected an increase of several thousands of dollars in our revenue from these meters alone. During the past seven years we have maintained this increase with an average total cost for maintenance of large meters of approximately $700 per year. This maintenance requires the services of two of our meter repair men for three months during the summer, one-third of which work is done at night for the convenience of those customers who do not have by-passes. We might say also that all new meter installations have for the last seven years included by-passes for convenience in field maintenance and testing.

This plan of meter maintenance may seem complicated at first, but as a matter of fact, once you have started the plan, it becomes very simple. We serve a population of between seventy-five and eighty thousand with over sixteen thousand services, yet we follow this plan by utilizing the services of only two full time men and one man part time in the meter shop. On the outside we operate two meter service trucks full time and one part time.

It must be remembered that these men in the meter shop not only take care of the "seven year" (small) meters, but also all other meter maintenance and tests as revealed in Table 1—here reproduced from Part I of this series in the September, 1939, issue. The outside men take care of all the meter traffic as shown in the same table, and also all meter leaks, attention to meter boxes, check readings, and special investigations on the consumers' premises to locate causes of abnormal consumption.

We are very much interested in the efforts that some of the meter manufacturers are making to improve their meters. A better meter

TABLE 1
ANNUAL METER TRAFFIC THROUGH METER DEPARTMENT

	1936	1937
Meters Reset (Reinstalled)	2,335	2,155
Meters Removed for Test (Seven Year Plan)	1,699	2,078
Meters Removed for Termination of Contract	1,880	1,843
Meters Removed for Non-payment	268	211
Meters Removed to Secure Contract	135	125
New Meters Tested	200	250
	6,517	6,662
Total Meters Tested	4,182	4,507
Total Meters Requiring Repairs	1,836	2,226

will perform longer, bring in more revenue, and should cost less to maintain. We are solidly behind any movement towards the incorporation in water meters of more ruggedness, a straight line accuracy curve, and sustained higher accuracies on the very low rates of flow.

And, In Conclusion

In conclusion may we say that this treatise has been written with the hope that those who have not adopted a routine meter maintenance plan will realize the importance, necessity, and economy of such a plan and that they will be enabled to start such a plan. At the same time, it is not wisdom to go beyond economic limits in such a plan and procedure.

It has also been written with the hope that those who have been following such a plan may be enabled to test its efficiency or improve such.

It has also been written with the hope that some of the doubt and uncertainty may be eliminated from what has in the past seemed to be a rather intangible phase of water utility operation.

80 Year Old Wooden Sewer

A section of very old wooden sewer was recently found in Chicago by workmen digging for a new sewer under Michigan Avenue. It was stated by officials that the sewer was constructed 80 years ago.

"SUPERCHLORINATION PRACTICE"

A Discussion

To the Editor:

Mr. Faber is to be commended for his paper in your September issue on "Superchlorination Practice in North America". His studies have given us an explanation of why there have been failures with superchlorination when something short of the optimum excess of chlorine was used.

Based on limited experience with high chlorination, as far as the writer knows there is no constant relationship between the amount of chlorine required to give a bacteria killing residual and the additional amount necessary to produce organic-matter destroying superchlorination. Under the sub-title of "What Constitutes Superchlorination" Mr. Faber says, "A superchlorination dose for one water will not be a superchlorination dose for another water". This statement cannot receive too much emphasis. By actual tests only, is it possible to determine the required dosage of chlorine to produce superchlorination.

In superchlorination it is absolutely necessary that all odor and taste producing compounds, organic or inorganic, be effectively oxidized. In other words, superchlorination for taste destruction is not accomplished until such oxidation is relatively complete. When these oxidizing processes are complete, there is produced what the writer likes to call a "Stable Residual". A "Stable Residual" may be described as that residual which is found by testing for residual in the same sample, at least thirty minutes apart, and obtaining identical values. If sufficient chlorine is added to the water to complete all oxidizing processes in the available time allowed for detention within the plant, then the residual will remain nearly constant.

Repeated observations of plant practice show that a "Stable Residual" will persist for several hours (ten and more) in relatively large storage tanks. Following complete oxidation, the release of chlorine, or the loss of chlorine, from solution is extremely slow, but is accomplished rapidly only by dechlorination. This, of course, refers to water not exposed to strong sunlight.

Mr. Faber mentioned granular activated carbon as a dechlorinating agent and spoke of the definite advantages of this material. However, all water passing through granular activated carbon *must first be filtered*. This is especially true for waters containing organic material. Chlorination oxidizes all organic matter, and this organic matter tends to precipitate out of solution during long periods of detention. However, there is a portion of this organic matter which may remain in suspension for indefinite periods. When such water is passed through beds of granular activated carbon, the carbon acts as a strainer or filter. After some period of time the granules of the carbon become impregnated with this organic matter and each granule of carbon acts as an incubator. Troubles of this nature caused by the straining out of organic matter were described in a paper written by C. P. Harnish, Chief Engineer of the Southern California Water Company. (Journal of the American Water Works Association, Volume 29, on page 66), which describes in detail some of the difficulties encountered.

It might be well to point out that *following* superchlorination, activated carbon does not act as an odor or taste removal agent. After superchlorination, its only function is the removal of all traces of chlorine. When superchlorination is carried out to its proper degree, there cannot be any odors or tastes except chlorine, remaining in the water. It has been the writer's experience that activated carbon alone will not always remove odors and tastes produced by the iron and sulphur group of bacteria.

The capacity of granular activated carbon when used for dechlorination is still somewhat of an unknown. Water with a residual of 0.5 p.p.m. of chlorine has been successfully passed through beds of granular carbon at the rate of 3 g.p.m. per cubic foot of carbon for short periods. The average rate at Culver City, (the plant mentioned in the above reference), is at present over 2 g.p.m. per cubic foot. Either of these rates is higher than that recommended by the manufacturer when the carbon is used as an odor and taste removal agent. How long such high rates may continue the writer does not know, but these beds have now been in operation over two years since recharge.

In the use of sulphur dioxide as a dechlorinating agent, the writer has made a practice of leaving a chlorine residual of 0.05 p.p.m., which serves as a control for the amount of sulphur dioxide necessary.

LOUIS J. ALEXANDER,
Southern California Water Co.,
Los Angeles, Calif.

N. E. W. W. A.'S. 58th ANNUAL CONVENTION

(Part II)

THE first installment of this report covering the 58th Annual Convention of the New England Water Works Association held in Montreal, September 12th-15th, appeared in our October issue. This second installment completes the report.

The New Filtration Plant of Lawrence, Mass.

"Construction and Operation of the Rapid Filters of Lawrence, Mass." by ARTHUR L. SHAW and E. SHERMAN CHASE, of Metcalf & Eddy, Boston, Mass.

This paper, presented by Mr. Chase, described the new and complete rapid sand filter plant which functions ahead of the old slow sand filters that have served Lawrence, Mass., for many years, but in recent years found to need assistance in coping with the increasingly polluted Merrimac River. The new plant, designed for 10 m.g.d. output, is at present equipped to deliver 8 m.g.d.

Units of equipment described are the following:

Mechanical Intake Screens—by Chain Belt Co.

Raw Water Pumps (combined capacity 18 m.g.d.) by Allis-Chalmers.

Venturi Meters and Instruments—by Builders Iron Foundry.

Coag. Basin Level Control Valve (Dow Pivot Valve)—by Chapman.

Chemical Feeders (Alum, lime, activated carbon; 6 units)—by Syntron.

Chlorinators (pre and post chlorination)—by Wallace & Tiernan.

Rapid Mix Mechanism (vertical shaft paddle type; .5 to 2.0 r.p.m.; detention at 10 m.g.d. = 15 min.)—by New England Tank and Tower Company.

Flocculators (3 horizontal paddles of 11 ft. diam. in first quarter of each of 5 coag. basins; peripheral speed 25 to 100 f.p.m.)—by Dorr Co.

Coagulation Basins—(5 units, covered, 4 hr. detention at 10 m.g.d.).

Settled Water and Wash Water Pumps—by Allis-Chalmers.

Filters—10 units (8 equipped) have 18" gravel and 30" sand bed of 0.46 mm. effective size and uniformity coefficient 1.9 with 30" free-board for washing rates at 24 to 34 inch rise; have perforated C.I. underdrains and are equipped with the Baylis Surface Wash System (42 jet nozzles per 1 m.g.d. unit).

Operating Tables (controlling 5 hydraulic valves each)—by Norwood Engineering Co.

Filter Rate Controllers (8 units 24" each)—by Builders Iron Foundry.

High Service Pumps—by Lawrence Machine & Pump Co.

Aerators—70 Sacramento Type Nozzles (capacity of 100 g.p.m. per nozzle) have 2 lb. cones operating under 4 ft. head.

Slow Sand Filters (old)—2.25 acres operating at 4.4 m.g.d./acre.

The plant was constructed at an overall cost of $628,600.

Leland G. Carlton, Sup't., Springfield, Mass. (1st Vice President)

Francis H. Kingsbury, Mass. State Dept. of Health (2nd Vice President)

Concerning operating experiences to date, Mr. Chase reported that the rapid mix and flocculators had early proved their worth. Also had prechlorination, on plant performance in general, proved its worth. Aeration had not been required; powdered carbon only during algae troubles; surface wash only intermittently; pre-chlorination continuously; post-chlorination provided a residual of 0.10 p.p.m.; lime to effluent for correcting pH to 7.2.

After hearing the efficiency data of the rapid plant many wondered why the continuation of the old slow-sand units. The answer is that Lawrence has Massachusetts' most polluted raw water to deal with and the State Dept. of Health is taking no chances—so stated F. H. Kingsbury, Sr. Asst. Engineer of the Department, and the new Vice-President of the Association.*

Canadian Speakers

H. G. Hunter, Cons. Engr., Montreal; G. T. Heeney, Water Dep't., Ottawa; A. K. Grimmer, Manager, Tamiskaming

"An Appraisal of P.W.A. and W.P.A. in New England" by W. W. BRUSH, Editor, "Water Works Engineering," New York City.

Mr. Brush's analysis of P.W.A. and W.P.A. financed water supply projects in New England revealed that 111 communities had benefitted from $14,047,000 in grants through the most recent P.W.A. program on projects costing $33,000,000; and, through W.P.A., $325,000,000 for all purposes, including water. He pointed out that for the U. S. on the whole there had been put through, under the 1938 P.W.A. program, 2,691 water supply projects, costing $308,000,000. In respect to proportion based on population, New England had received something better than its share of P.W.A. grants. On the whole the P.W.A. work had proved very satisfactory, whereas under W.P.A. cost of $6.00 to $8.00 per foot for laying 6 and 8 inch pipe seemed a rather costly benefit.

Several New England State Sanitary Engineers commented on experiences with and benefits secured through Federal aid in their respective states, in which it was stated that even under W.P.A. purification plant construction had cost only about 25% more than by the customary contract procedure. It was also pointed out that P.W.A. deserved credit for having injected a model system of accounting into construction procedure in the municipal field, something existing with rarity before P.W.A.

"100 Years in the Water Works Field" by S. W. KITSON, Worthington Pump and Machinery Corp., Harrison, N. J.

Mr. Kitson's paper, profusely illustrated with slides, reviewed some highly interesting history in pumping and pump developments in America, since the invention of the first boiler feed pump of Henry R. Worthington, September, 1844. The very first steam driven water pumps

*In the first installment of this report from the list of new officers we discovered too late that the 2nd Vice President was omitted. To F. H. Kingsbury, elected to that office, our sincere apologies.—Editor.

(1) Wm. D. Hartford, Pres. Water Board, So. Norwalk, Conn.; (2) John A. Morley, Pittsburgh Des Moines Steel Co., New York City; (3) Fred B. Nelson, Engr., Dep't. of Water Supply, New York City; (4) Thos. L. Cate, Sup't., Laconia (N. H.) Water Co.; (5) J. W. Wickwire, The Edson Corp., Boston, Mass.; (6) Wm. Naylor, Sup't. Water and Sewerage, Maynard, Mass.; (7) S. S. Anthony, Sup't. Water District, Augusta, Me. (Served as Chairman of the Sup'ts.' Session); (8) Jovial "Al" Lash, Geo. A. Caldwell Co.'s "Ambassador of Commerce"; (9) Percy R. Sanders, Sup't. Water Dept., Concord, N. H.

were installed in Savannah, Ga. (1854) and Cambridge, Mass. (1856). Interestingly the principle of a water meter, invented in 1855, resulted in the design of the first duplex type pump of 1859. Then came the famous Holly System of pumping direct into the mains, to make history at Auburn, N. Y., in 1866. Of the flywheel type pumping engines Cincinnati, Ohio (1886) had the first; then in 1904 the direct acting condensing type staged a comeback in the Chicago installation and, thereafter, such pumping engines took the lead.

Concerning centrifugal pumps, the very earliest was 1818 but such pumps were not successful until 1846. In 1911 turbine gear driven centrifugals appeared. Then (1926) came the synchronous type motor, which really put centrifugal pumps on the map. Mr. Kitson then showed pictures to reveal the comparative space requirement and initial costs of the old types of pumping engines and modern centrifugal units, now raised to overall efficiencies of 90% and better. In some detail Mr. Kitson described the newest "mix-flo" centrifugal type of water and sewage pumps, especially suitable and efficient for low head duty.

"Back Flow in Plumbing Systems" by R. H. ZINKIL, Consulting Engr., Crane Co., Chicago.

Mr. Zinkil's paper, read in his absence by W. A. Dallach of the same company, constituted a review of progress made in correcting the back-syphonage hazard and developments in the direction of valves and equipment designed as vacuum breakers and preventers of backflow of pollution into water pipes. He described the Type "A" preventer for individual fixtures, which has moving parts, and Type "B" without moving parts. The paper then presented a proposed series of useful tests for critical levels between the inlet nozzle and water level in fixtures; also, performance tests to be applied to back-syphonage preventers for direct flushing valves on toilets.

Mr. Zinkil closed with a further evaluation and the preference for the type "A" (moving-parts type) preventer, because of the more exact design needed for a variety of pressures and the noise problem. Those interested in this topic would do well to go thoroughly into Mr. Zinkil's very comprehensive paper.

Sup't.—Pres.—Mgr.

Wm. P. Melley, Milton, Mass.; Theo. L. Bristol, Ansonia (Conn.) Water Co.; Geo. C. Brehm, Amhurst (Mass.) Water Co.

Committee on Committees Makes First Report

"Report of Committee on Research and Water Practices" by WARREN J. SCOTT, Chairman.

Based on his recommendation while president of the association, a "Committee on Committees" was established, and Mr. Scott made chairman. In its first report two new committees were recommended — one on "Anti-Corrosion Treatment, Materials and Electrolysis" and another on "Ground Water Supplies." Of the 27 standing committees in N.E.W.W.A. two are to be discontinued, because of the existence of similar committees in the Association or joint committees on which N.E.W.W.A has representatives. Two more will probably be dropped. Within the year a "Committee on Rainfall and Yield of Drainage Areas" has been appointed with Arthur D. Weston as Chairman.

Recommendation was made that special studies be instituted in cooperation with engineering schools and supported in whole or in part by the Association.

"Automatic Priming System for Use with Centrifugal Pumps" by FRANK A. BROADHURST, Turbine Equipment Co., Boston, Mass.

Mr. Broadhurst described an automatic pump priming scheme which has been in successful use for several years now. The system makes use of a powerful eductor which goes into operation whenever a pump loses its suction for any reason. In operation, the water level in the pump is drawn to a point above the unit. As soon as all air is replaced by the rising water, into the primer chamber, electrical contact is made between two copper electrodes, then submerged, and the eductor is cut out. If the water drops or air accumulates in the chamber the eductor goes into action. A large vacuum chamber, set into the discharge line, will serve also as a stand-trap and the device will function as a low-water cut off. Besides preventing pumps from running dry it steadies pump discharge under varying suction lifts.

Mr. Broadhurst stated that the system (now 11 installations) had proved satisfactory for sewage pumps as well as water pumps. The only parts requiring replacement are the electrodes which cost approximately $20 per pair.

Superintendents' Session

(Sidney S. Anthony, Presiding)

Cold weather troubles and their correction or prevention were featured in the Superintendents' Session.

"Standpipes and Ice Troubles" was introduced by H. G. HUNTER, Asst. Engr. with W. S. Lea, Consulting Engineer, Montreal.

Mr. Hunter cited experiences in temperatures reaching 51 below zero, in which standpipes frequently froze solid or nearly so. The ice cylinder released by thaw from the

(1) Ed. Case, President, Pitometer Co., N. Y. City, and Jo. Tracy, Pitometer Dist. Mgr. of Albany, N. Y.; (2) Senator Geo. A. Boultes, Commissioner, and Francis P. Hatch, Supt. of Water, Kittery, Maine; (3) Norris Whitcraft, Bingham and Taylor, Buffalo, N. Y., and "Ross" Scott, Water Works & Sewerage Engineer, Dresser Mfg. Co., comparing notes at Dresser's booth (looks like a posed picture but "candidly" it ain't); (4) Chas. Harris, Supt. of Water, Hinsdale, Mass., and Frank P. Hall, Supt. of Water, Athol, Mass.; (5) W. S. Mills, of Peacock Bros. (Canadian representatives of Foxboro Co. and Nordstrom Valves), Toronto, and Jos. O. Meadows, Chemical Engr., J. T. Donald & Co., Engrs., Montreal.

tank walls would then float, projecting high above the tops of standpipes to present bizarre pictures. (This makes a good "believe-it-or-not" story of a standpipe which held one and a quarter times its full capacity of water without flowing over.—ED.)

Experiences led Mr. Hunter to warn against other than cylindrical shaped tanks because of ice troubles.

WALTER BUSHWAY, (Supt. Brookline, Mass.) in commenting on the spheroidal shaped tank recently completed in Brookline, said that they had considered the shape and ice effects. However, during extreme weather well water would be kept flowing through it into the adjacent reservoir. Tensometer tests recently applied to the spheroid revealed stresses equal vertically and horizontally.

S. S. ANTHONY, (Supt. Augusta, Me.) had a tank to freeze over. Thereafter the water drop created a partial vacuum under the ice seal. Result, automatic pump kept kicking in due to false recording of drop in water elevation, although in truth a drop in head.

PERCY SAUNDERS (Supt. Concord, N. H.) told of Concord's 5 ft. diam. tank riser freezing solid and splitting seams. After that a 10 in. riser pipe was installed at the center of the 5 ft. cylinder, and the annular space filled with granulated cork supplied in 200 lb. bags at a cost of 7¾ cts. per pound. A second tank riser had been given the same treatment since.

W. W. BRUSH said that Mr. Saunders had little to fear since he had been familiar with tests showing 3″ of cork around a 1″ dead pipe line. Such had prevented freezing for 120 hours at 8 below zero, whereas an unprotected parallel pipe had frozen in 2 hours time.

H. E. HALPIN (Engr., Assoc. Factory Mutual Fire Insurance, Boston) told of automatic heaters employed to prevent freezing of dead storage tanks, providing factory fire protection.

"Some Problems of Winter Operation" by A. K. GRIMMER, Town Manager, Temiskaming, Quebec.

Mr. Grimmer said in effect—"You New Englanders don't know nuthin!" At temperatures around 40 below zero for much of the winter, Temiskaming had REAL problems. Some service lines had to be run through 30 x 30 in. boxes filled with sawdust. Such had proved protective down to 10 below zero, but not lower. His "gift from Heaven" was the lead sheathed soil heating cable, such as employed in greenhouses, which was extensively used in Temiskaming to prevent freezing. (1) Alongside of pipe in the sawdust boxes, it protected down to 50 below zero; likewise shallow under-

Sup't.—V. P.—Engr.

Geo. F. Merrill, Sup't., Ware, Mass.; Wm. C. Hawley, V. P. & Mgr., Penna. Water Co., Wilkinsburg; Theo. LaFreniere, Chief Engr., Quebec Ministry of Health, Montreal.

ground service lines were laid in conduit with the cable. (2) For winding around fire-hydrants kept covered with a hood; also was used for thawing frozen hydrants. The soil heating cable referred to, produced by the leading electrical equipment manufacturers, is extensively sold to florists. It comes in standard 60 ft. lengths, heats to 175 deg. F., takes 3 amps. at 110 volts per 60 ft. length; sells for about $7.00 per 1000 ft. Mr. Grimmer exhibited a section of the cable so strongly endorsed.

In electrical thawing, arcing trouble at main joints had been corrected by using 600 amps. at 50 volts.

"Protecting Overhead River Crossings" by G. T. HEENEY, Resident Engineer, Water Department, Ottawa, Ontario.

Mr. Heeney described the protection of a 48″ steel-cylinder concrete main crossing the river on a steel trestle. The scheme consists of constructing a cylinder of "hi-rib" steel lathing around the pipe and wrapping with "rock-cork" sheets, covered with asbestos mortar. Through the annular air space is run two ½″ steam lines. Specifications called for no freezing at 30 deg. below during the first 6 hours. To date the most severe test had been 5 days of below zero temperatures when thermometers in the annular space registered only 26 degrees. It is assumed, therefore, that the specification is met.

"Some Phases of Public Relations" by HAROLD L. BRIGHAM, Supt. of Water and Sewerage, Marlborough, Mass.

Mr. Brigham's paper constituted what may be termed the "Dos and Don'ts," in building public relations and good will for the municipally owned utility. Filled with good pointers, such as politeness of employees, trim appearance of properties and equipment, cultivating the younger generation in the schools today as your bosses of to-morrow, telling civic organizations what's behind their water faucets, giving prompt, courteous attention to complaints, and finding an answer to all questions — Mr. Brigham warned that a complainant may be later met with on the important Town Finance Board. He told of basic material prepared for the purpose of handing to school children for their use in preparation of papers on the local water supply.

On Mr. Brigham's paper there was considerable discussion. *LELAND G. CARLTON,* formerly Registrar and now Supt. of Water, Springfield, Mass., cited the demonstrated value of notifying customers before that always troublesome high

(1) "Hydrotite's" Reggie Hayes and Hersey's Herman Smith (In charge of Manufacturer's Exhibits); (2) From Bangor, Maine, came D. P. Johnson, Ass't. Sup't. and "Al" Read, Sup't.; (3) Cement Lined Pipe's H. W. Jacobs, Gen'l. Mgr., and "Walt" Arnold, who finds business "on the up"; (4) "Supers" Wm. B. Duffy (No. Andover, Mass.) and Sam G. Wylie (Webster, Mass.); (5) F. O. Simpson, one of six representatives of Pittsburgh Equitable Meter attending (claimed there weren't enough convention prospects to go around), and Boston's "Gil." Pratt, one of W. & T.'s "war-horses", who has lived to see New England become chlorine minded.

bill is delivered to him, thus avoiding a rumpus in the office.

As to the matter of adjusting high bills, traced to hidden leaks, Mr. Brigham stated that in justified cases the water wasted is billed at actual cost of production. The customer could understand this gesture and was usually satisfied. It developed that at Manchester, N. H., and Taunton, Mass., the practice is to split with the customer the excess on such bills.

W. C. HAWLEY, Vice-Pres. and Supt., Pennsylvania Water Co., Wilkinsburg, Pa., advocated monthly meter readings and quarterly billings as a means of making more friends.

The scheduled initial report of the "Committee on Emergency Procedures" by *DONALD C. CALDERWOOD* (Chairman) was postponed for presentation and discussion at one of the early winter meetings in Boston.

With a vote of thanks to *W. S. LEA,* Montreal Consulting Engineer, for his valued assistance in respect to the technical program and local arrangements, the meeting was adjourned.

CUBIC YARDS IN A CONICAL PILE

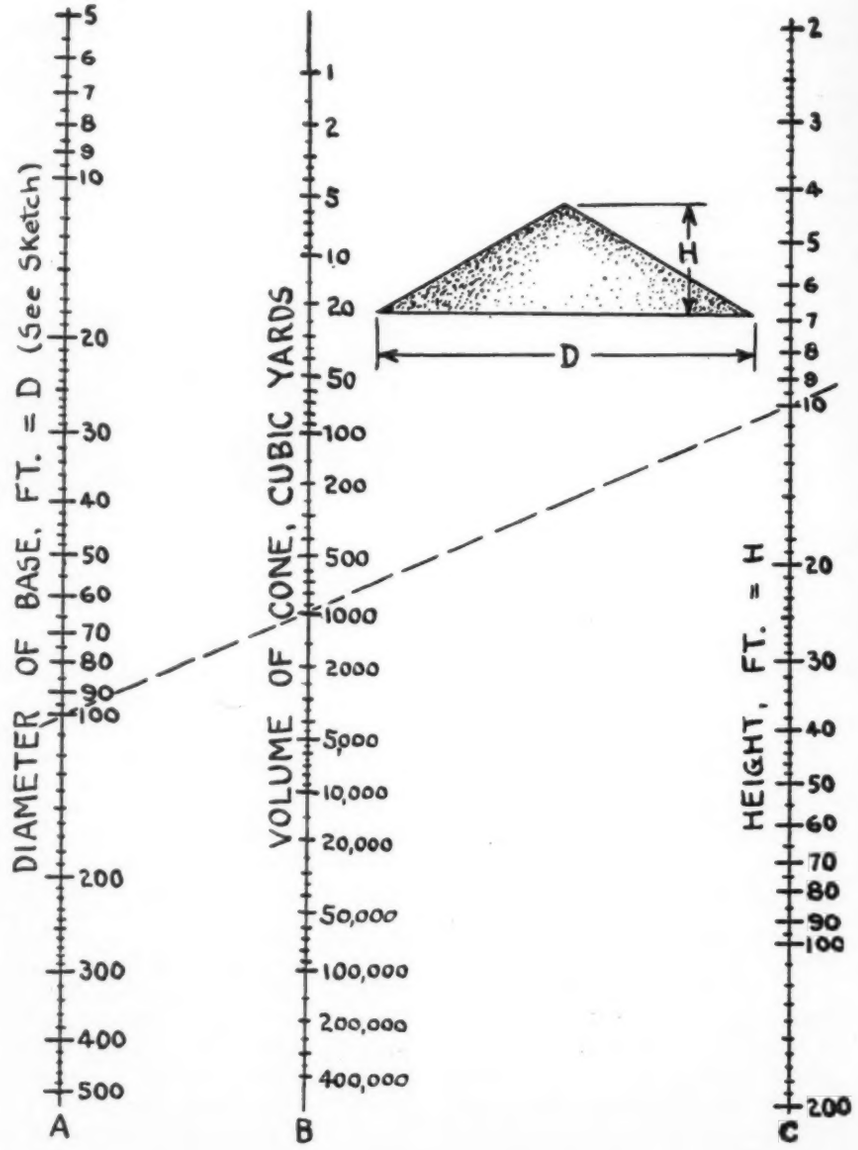
Frequently it becomes desirable or necessary to estimate yardage in a pile of dirt, sand, stone, gravel, coal, etc.

Without any figuring whatever the accompanying chart quickly gives the number of cubic yards in any conical pile.

For example, how many cubic yards in a conical pile whose base diameter is 100 ft. and whose height is 10 ft.?

The dotted line drawn across the chart shows how it is done. Run the line through the 100 ft. diameter, column A, and the 10 ft. height, column C, and the intersection with column B gives the answer as a little less than 1000 cubic yards.

The range of the chart takes care of all diameters from 5 to 500 ft. and all heights from 2 to 200 ft. However, in the event that diameters or heights should be greater or less the same chart is still applicable. Thus if the diameter should be 1000 ft. instead of 100 ft. and if the height should be 100 ft. instead of 10 ft., the same dotted line would solve the problem excepting that the answer would be 1,000,000 cubic yards instead of 1000 cubic yards. In that case the rule is this: For every cipher added to column A, add two ciphers to the answer in column B, and for every cipher added to column C, add one cipher to the answer in column B. This means that when the problem is 1000 ft. diameter and 100 ft. height, three ciphers must be added to the result in column B.



WATER AND SEWERAGE SYSTEM SAFETY*

By CARL A. HECHMER**
Department Engr.
WASHINGTON SUBURBAN SANITARY DIST.
HYATTSVILLE, MARYLAND

SAFETY work and prevention of accidents in all fields is being given more attention, every day, to eliminate needless property damage, expense and loss of life.

That accidents *do not happen but are caused* we must all agree, and alertness in removing potential causes of accidents will go a long way toward solving our problem.

Mention of a number of hazards which confront us who are engaged in water and sewerage work should arouse an interest to improve our methods and bring about more satisfactory operation. The author has only met and realized a few of these hazards which are presented herein, and the solutions offered are open to considerable debate as to the effectiveness under all circumstances.

Water System Safety

Taking water system safety; first, let us consider the hazards which are caused when water is turned off to allow new connections to be made to the system or to repair a broken main. It is the practice of all well operated water systems to notify all consumers before turning off the water, telling them approximately how long the shut down will be effective and give each one an opportunity to draw sufficient water to meet their needs during the shut down period. All men employed on this type of work should be qualified to advise the housewife regarding the operation of the furnace or hot water heater, to caution her not to draw the water out of the hot water boiler but to relieve the steam pressure, which may build up, by occasionally opening the hot water faucets upstairs.

Recently the writer was involved in a complaint claiming damage due to personal injury and the question as to the legal claim of the water consumer for such damage caused by an accident when the water service was resumed after a shut down was discussed. The opinion of one attorney was to the effect that a second notification should have been made prior to *turning on* the water. The details incident to this accident are as follows:

The Author

Repairs to the water system near a lunch-room necessitated shutting down of the water service for two hours and the counterman in charge of the lunch-room was notified to this effect before we started to close the valves. When the repair was completed the repair foreman turned water service back into the main, taking all precautions to remove air through a fire hydrant, while charging at a low rate of flow. A short time after service was restored the foreman was advised that the counterman in charge had been badly burned by the explosion of a coffee urn and soon an ambulance arrived and took the injured man to the hospital, badly burned about the upper part of his body with scalding water. Investigation disclosed that the urn was a three compartment affair, two for coffee and the third, encasing the other two, for hot water. This formed a reservoir for hot water storage and a heating jacket to keep the coffee hot. Water is drawn from the hot water compartment from a faucet, into measuring cans and poured by the attendant into the top of the coffee compartments. The water supply in the hot water compartment is replenished through a direct pipe connection to the water system, controlled by a spring operated lever valve which must be held in the open position by the attendant. The counterman claims that when water service was restored and was available in other parts of the lunch-room, he opened the valve to fill the hot water compartment, but that air under great pressure rushed into the urn causing the scalding water therein to be blown out of the top and over him. It is possible that most of the hot water had been used during the shut down, exposing the heating coils to the gas burners and that when cold water was turned in steam was formed causing the explosion. The claim for damage and injuries has not yet been settled.

It is the practice of the Washington Suburban Sanitary District employees to notify each house sufficiently in advance of a shut down to permit the drawing of enough water by the occupant to tide over until service is restored. We always give an estimate of the length of time the water will be turned off and make every effort to restore service within the time specified, although occasionally unforeseen emergencies require a longer period. If no one is at home a written notice is left at the door, a supply of forms being furnished each foreman for this purpose.

Dangers of Air in Mains—

Charging a main too fast and the ineffective release of air is a potential cause of many accidents both to the water system, the property served, or the water consumer. Air trapped in a plumbing system may cause rupture of the pipes or heating tank, since the air becomes compressed and will exert greater pressure. Air from a faucet may cause a glass or other utensil to be knocked out of the hands of the person attempting to draw water. Rupture of a main in the street or a broken meter may result from air and cause flooding of cellars and property damage.

Providing goggles for men out on the ditch who must cut pipe or concrete paving is good safety practice. Most every shop provides such protection for men welding metals or using grinding wheels but few de-

* Portions from a paper presented by the author before the Maryland-Delaware Water and Sewerage Association.

** To the author was recently presented the George W. Fuller Memorial Award by the 4 States Section of A.W.W.A., in recognition of his ability, service, and leadership.—Ed.

partments provide such protection for outside forces.

Sewerage Hazards

The hazards of Sewerage System maintenance are not sufficiently recognized by most engineers and, unfortunately, to even a lesser degree by the men actually working in manholes and sewers. There are a number of insurance companies that consider inspectors, foremen and workmen on sewer maintenance and repair as being engaged in a prohibited occupation for life or accident insurance. Safety practice is, therefore, of continuing importance in this field of work and cannot be emphasized too greatly.

Maintenance Work

Proper venting of a sewer line by opening several manholes adjacent to the one to be entered should receive the attention of every foreman before allowing men to begin work in the sewer. The various types of industrial wastes being discharged in sewers, especially from garages, filling stations and dry cleaning establishments, as well as danger from gas accumulations from leaking gas mains presents potential sources of explosives or toxic gases which endanger the men. The use of air blowers, hand or engine driven, which force air into the bottom of the manhole are worthwhile as a safety precaution and add considerably to the comfort of the men. No man should be allowed to remain down in a manhole without another man on the surface beside it. Not only does the top man prevent accidents from occuring by keeping pedestrians and traffic away from the top of the open manhole, but he can keep an eye on the man below should he show any effects due to inhaling toxic gases or to an oxygen deficiency. Proper ventilation will also remove explosive gas accumulations which might be ignited in maintenance operations. It is obvious that men working in sewers should not be allowed to smoke or carry lighted lanterns or flares into the manholes. The use of mirrors to reflect sun light or safety flash lights are safe means of providing light in the sewer.

The use of safety belts in very deep manholes as a precaution to enable quick and safe removal of a man is good practice and enables help to be given an affected worker without endangering a second man. To pull a limp man from a deep manhole is the job for two men on the ground.

Sectional Gate Safety-Fence in Place on a Main Highway.
(Note lantern hooks and flags in sockets.)

Instruments for the detection of explosive and toxic gases are now available and are comparatively cheap, costing slightly over $100.00 for both types. These instruments are rugged, enabling them to be carried around without damage, small and light, and very simple to operate. By their use one may readily detect the presence of these gases as well as their concentration and they are more easily carried and maintained than the canary bird formerly used for this type of work.

Pump Stations and Plants

Proper ventilation in sewage pumping stations and disposal plants, especially at the latter where gas resulting from sludge digestion is confined for use as power to drive a gas engine or for heating purposes, is also very important if maximum safety is to be provided. While the control of such gases and their exclusion from buildings occupied by operators is a matter of design, the proper functioning of the apparatus provided for such control can only be assured by frequent test with gas detectors. Permanent installation of such detectors with automatic alarms to call attention to the existence of dangerous atmospheric conditions is now possible and should not be overlooked (See WATER WORKS & SEWERAGE for January, 1939, page 32.)

Chisels, hammers, screw drivers, caulking tools and all types of hard metal tools are now available in very hard copper base alloys, to avoid sparks from flying and possibly setting off an explosive gas in a sewer or sewage treatment plant.

Safety Gate—Barricade

In the Washington Suburban Sanitary District a type of safety gate for protection of the public from open ditches has been used for some time with success. The gates are each 3 ft. long by 3 ft. high made of slats 6 inches wide by one inch thick, spaced ten inches apart. They are built like a gate, each end being provided with iron rings and bolts which permit one gate to be fastened to another and the fence barricade to be made as long as necessary, and circular or rectangular as the shape and size of the excavation requires. Each gate is provided with a flag staff holder and a hook for a red lantern. The gates are stripe-painted white and black, the strips more recently being put on vertical instead of diagonal, to simplify painting. The black and white scheme is, of course, to attract attention at a greater distance.

Placement of Signs

The use of {Danger / Men Working} signs during regular working hours, and {Danger / Open Trenches} during other times, is practiced by most utilities in these days of increased traffic, and the water and sewer department should provide each job with a sufficient number of these signs to protect the public at all times. Proper placement of these signs, however, is as important as the type of sign or the wording thereon. Where excavations

are on or near curves in the roadway or near the top of a hill, signs should be placed where the driver of an automobile may see it before he is right upon the excavation, without a chance of slowing down his vehicle.

Another potential source of real danger, and the cause of many accidents, is the use of gasoline and kerosene on the construction or maintenance job. The use of the same type and shape of can for both gasoline and kerosene should be avoided, even if one is painted a different color than the other, for a laborer in a hurry, especially at night, may pick up the wrong can and use its contents with disastrous effects. The filling of lanterns without turning them out is another very common practice and the cause of many a burned man.

First Aid, in its proper phase and application, forms a very important item in safety control. In sewer maintenance, where there is an especially likely chance of infection, no cut or scratch, no matter how small, should remain untreated. It is good practice to provide each sewer maintenance gang with a strong soap and a disinfectant, such as Lysol, and require that they wash their hands frequently, especially at the end of each day with them.

Automotive Equipment Operation

Automobile safety becomes of greater importance as the number of cars and trucks employed on the water and sewerage system increase. The drivers of these cars should be made safety minded in the prevention of traffic accidents. Not only will the department benefit by a lower repair bill, less lost time of vehicles and perhaps personal injury to the occupants, to say nothing of the cost of the damage to the other car and occupants, but goodwill of the public will be enhanced by careful, polite drivers; and, who among us does not strive to please our customers and improve public sentiment toward our department. Calling safety meetings for all drivers of department vehicles, providing a little entertainment together with a good talk on some important phase of traffic safety and driving has been productive of excellent results in our District.

During the past two and one-half years automobile safety meetings have been held every two or three months. Whereas, the line on the graph showing the number of automobile accidents per year, prior to the safety campaign, was increasing faster than the growing number of cars and trucks in service on our work, a marked change has taken place since and the curve of accidents in total number per year has declined in spite of continued increase in the number of cars in service. The accidents which have occurred have also been comparatively minor in character as compared with the previous record.

It is realized there are dozens of causes of potential accidents on every water and sewerage system for every one that has been covered in this paper, and even more numerous solutions for each one. However, if those who hear or read this discussion will become safety minded and apply their own judgment to the different phases of their work, then this paper has accomplished its purpose and the time required for its preparation and presentation has not been lost.

YULETIDE!

A Plant Beautiful and a Novel Candle Stick

THESE two pictures came to us early this year as "Christmas Ideas" but we decided to save them for more seasonal use, with the thought that many other managers may find the idea of putting a Yuletide touch to their plants worthy of consideration. In fact there are many plants which have such attractive fir and balsams on the grounds that outside tree lighting would make a festive showing for the passers-by, as did the "Giant Candlestick" here pictured.

To L. S. Duckworth, Plant Superintendent, at Lancaster, Pa., we are indebted for the interior picture of the Lancaster Filter Plant at Christmas time. The 32 evergreen trees came from Lancaster's water shed, so did material for the wreaths. More than 1800 colored lights were employed on trees and wreaths, the system being arranged so as the lighting effects changed every 8 seconds, to present a rotation of changing color schemes to fascinate the visitor. Other parts of the building were also decorated and a public address system provided a musical background from recordings of Yuletide chorals and organ selections.

During the period of decoration 33,586 visitors were actually counted —many more not counted. The newspaper accounts and local radio an-

The Lancaster Filter Plant in Yuletide Garb
Through a public-address system organ music flooded the building from recordings.

nouncements brought them to see the effects, and incidentally to learn something of Lancaster's Water Works, which can boast one of America's most attractive and effectively interior decorated plants, *at any season*. In the Lancaster Filter Plant are to be found interesting miniature gardens — the largest one having in it more than 600 living plants. And, almost everyone finds interest in such miniature gardens as these. Besides, it's something which the local papers can talk about as worth while going to look at.

Concerning outside Yuletide decorations, Lancaster illuminated its evergreen trees surrounding the plant in an effective manner also—and incidentally, the equipment needed can be charged off over a period of years.

The interesting "Giant Candlestick" here pictured (not at a water plant, however) was constructed of two sizes of light weight Armco corrugated pipe—the candle proper being a 20 ft. length of pipe and the holder is a section of larger diameter and light weight sheet steel. The candle-stick was painted with gilt paint, the candle a bright Christmas red, and the whole effectively floodlighted. The flame was lighted with a 200 candle bulb. Construction of the flame is not explained, but amber colored cellophane should prove a satisfactory material for the desired effect. In any event, it constitutes an idea of what can be done with such commonplace materials.

An Effective and Economical Giant Candlestick
Fabricated from corrugated pipes.

HYDROGEN SULPHIDE REMOVAL FROM WATER*

Not as Simple as It Might Be

"Sulfur Water" is the term applied to waters containing hydrogen sulfide and other sulphides. Such waters are extremely corrosive and cause many processing difficulties.

The usual method of removing hydrogen sulfide from water is by aeration, but experience has shown that this is inadequate for many sulfur waters. With such waters, it is found that complete removal of the hydrogen sulfide with air is impossible no matter how many trays are used nor how high the aerator is.

A depression of the pH value by using the carbon-dioxide content of flue gas has been found effective in such cases. Simply introducing the flue gas into the water is not effective. Instead, it has been found necessary to rain the water down *through* the flue gas in an enclosed chamber.

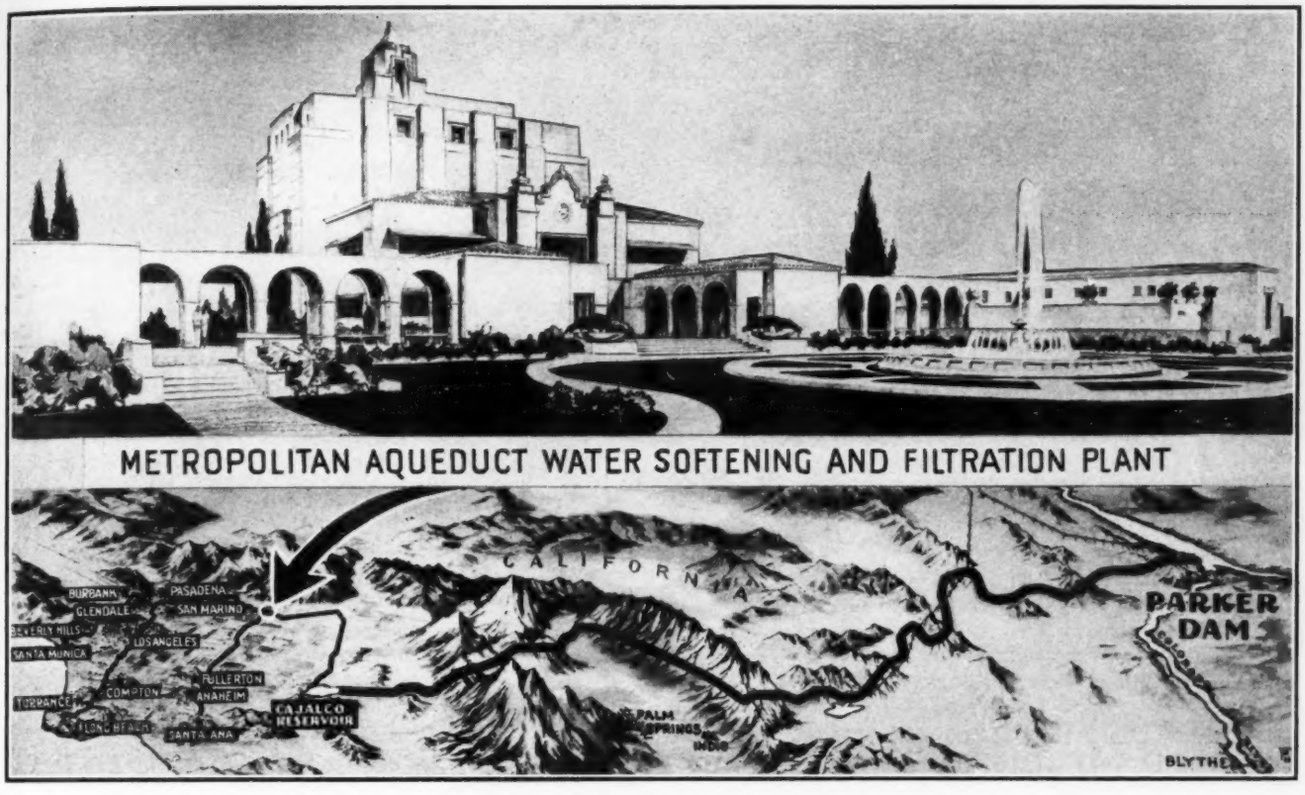
The equipment used in carrying this out is a two-chamber degasifier. The flue gas is blown through the water as it rains down through a series of super-imposed slat trays in the upper chamber of the degasifier.

This removes the hydrogen sulfide liberated by the carbon-dioxide and any excess of the latter gas is then removed by blowing a current of air through the lower chamber, through which the water rains over a series of superimposed slat trays. This treatment will remove all except a slight trace of hydrogen sulfide. If required, this residual H_2S may then be oxidized with chlorine.

Parenthetically, it might be remarked that removal of all the hydrogen sulfide by oxidation is not feasible. Experiments have proven that oxidation by dissolved air (oxygen) is too slow; in fact, no measurable change being detected over a period as long as two hours. If chlorine is used to oxidize all of the hydrogen sulphide the expense may be great and a milky water results from sulfur precipitated in the reaction $H_2S + Cl_2 = 2\ H\ Cl + S$ (molecular).

(*Much of this item has been taken from a paper by E. Nordell, of the Permutit Co.—"Conditioning Waters for Industrial Uses." Reprints are available from the author's company.—Ed.)

SO. CALIFORNIA WATER DISTRICT LETS CONTRACT FOR 100 M.G.D. SOFTENING PLANT



Architects Drawing of the Water Softening Plant

(Below is shown the route of the Colorado River Aqueduct. Thearrow indicates the location of the plant supplying the 13 member cities financing the $220,000,000 project.)

BIDS for a new water filtration and softening plant, to be built by the Metropolitan Water District of Southern California for handling Colorado River water intended for domestic and industrial uses, were opened in the offices of W. E. Weymouth, general manager and chief engineer of the Water District, on October 27, with the Griffith Co., of Los Angeles, submitting the lowest of eight bids for total-contract of $1,632,992.20.

Second lowest bid came from the George A. Fuller Co., Los Angeles, for a total-contract figure of $1,634,738—only $1,746 above the Griffith Co. bid. Six other bidders submitted figures.

Imposing in conception, combining architectural beauty with practical efficiency, the proposed plant is designed in an adaptation of the Spanish architectural style, with red tile roof, arcaded promenades and landscaped grounds. Its initial capacity will be 100 mgd. output.

The site is near San Dimas, 35 miles northeast of Los Angeles. Preparation of plans and specifications was begun around the first of the year by the design division of the Metropolitan Water District under the direct supervision of the consulting engineers, Charles P. Hoover and James Montgomery, of Columbus, Ohio. The plant will be of the lime-zeolite process type, which was recommended by Hoover and Montgomery as being the most economical and practical for this region.

Contract for furnishing and erecting certain mechanical assemblies was awarded in March of this year to the Dorr Co. at $79,993.35.

The new plant will provide filtered and softened water for Los Angeles and 12 other cities in Orange and Los Angeles counties, which united in floating a $220,000,000 bond issue for building the Colorado River Aqueduct and its distributing system.

A decision to follow the modern American trend for softened water influenced the District Board toward providing a plant for softening to a point that will make the supply of better quality than the water now generally being used by residents of the member cities in the District.

With the exception of Beverly Hills, none of the 13 cities now supplies its consumers with filtered water. Since Colorado River water for many years has been found to be of excellent quality for agricultural purposes no treatment is to be given that part of the supply going to irrigation uses.

C.S.W.A. CONVENTIONS AT OAKLAND

Then Visits Plants and Golden Gate Exposition

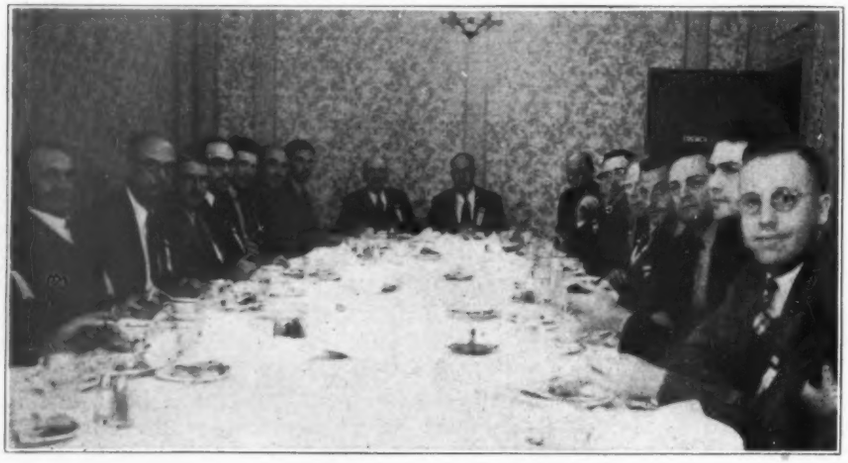
Reported by A. M. RAWN*
Associate Editor
LOS ANGELES, CALIFORNIA

TWO DAYS of business and the World's Fair marked the Twelfth Annual Meeting of the California Sewage Works Association, held in conjunction with the annual meeting of the League of California Municipalities in Oakland on September 18 and 19. A new innovation in the form of an Operators' Breakfast, held at 7:30 the morning of the first day of the meeting, proved to be a great success. Twenty-seven attended, all being operators but for a small group of guests invited to impart special information. The affair was informal and the operators were requested to speak freely concerning their problems. Discussion centered about plant records and mechanical equipment. Emphasis was placed on good operating records and their especial value in event of law suits; but it was intimated that *good* records of poor plants could be of far more benefit to the plaintiff than to the defendant plant owner. Nevertheless, it was the opinion of all present that records should reflect as accurately as possible the behavior of the plant and its managers.

Piston sludge pumps with ball valves were unanimously condemned. In each case the operator's story was the same: the pumps are difficult to maintain and the valves foul easily with the coarser materials found in sewage and sludge; the equipment is dirty; and the question "Why do we have such equipment?" brought forth a suggestion to invite the manufacturers of this type of equipment to an Operators' Forum. It is planned to continue this commendable feature, which allows operators to freely speak their minds.

Presidents
Col. H. G. Smith, Los Angeles (Incoming)
Alexander Bell, San Francisco (Retiring)

Annual reports submitted at the business meeting on Monday morning indicated that the paid-up membership in the Association was about 270, and that the affairs of the Association were in a sound financial condition. A number of amendments intended to simplify the Constitution and By-Laws were submitted and approved.



Operators' Breakfast
W. A. Allen, Plant Supt., Pasadena, Presiding

New Officers

The group elected Colonel H. G. Smith, Sanitary Engineer for the City of Los Angeles, president for the year 1940. Alexander Bell, retiring president, was elected to the Board of Directors, as was H. W. Jewell, Engineer for the Pacific Clay Products, Los Angeles. Fred Bowlus, of the Los Angeles County Sanitation Districts, was elected second vice-president; and William Ingram of Stockton, elected secretary-treasurer.

Following the technical session, the group met at noon luncheon where Walter N. Frickstad, City Engineer of Oakland, extended a word of welcome on behalf of Oakland's Mayor McCracken. Mr. Frickstad, commenting on the perplexing sewerage problem of the City of Oakland and its neighbors, said that the warm Indian summer weather which Oakland was experiencing, and the westerly breezes, would undoubtedly fully acquaint them with the seriousness of the situation which exists on Oakland's bay front.

Replying to Frickstad, President Bell remarked, in part, "It is timely that the California Sewage Works Association, comprising city officials, engineers and operators, should meet in Oakland, for Oakland has before it a real sewerage problem. Almost overnight the East Bay Cities' 'back yard' has become their 'front yard' —with possibilities for a most attractive front yard at that." In this connection, President Bell was speaking of the East Bay Cities' shore line upon which untreated sewage has been emptied for many years. Mr. Bell continued, "Therefore what might possibly have been disregarded as being hidden in the back-yards of these municipalities, is now brought into the spotlight to be viewed and noticed by citizens and visitors alike. It is gratifying to note the serious manner in which the East Bay Cities are attacking this problem and we hope that C.S.W.A.

*Ass't. Chief Eng'r., Los Angeles County Sanitation Districts.

may be of some service to them in the future."

Three Plants Visited

A specially conducted caravan visited San Francisco's Marina Pumping Station, its Golden Gate Park activated sludge plant, and the new Richmond-Sunset sewage disposal works in the afternoon. Monday night was dedicated to visiting the Treasure Island Fair as was Tuesday afternoon, since Tuesday was proclaimed C.S.W.A. day at Treasure Island.

Papers and Discussions

"Problems in the Operation of the Richmond-Sunset Sewage Treatment Plant" by BEN BENAS, Plant Superintendent, KEENO FRASCHINA, Assistant Supt., and R. R. SUTTER, Chief Operating Engineer, San Francisco.

Mr. Benas discussed the general problem of disposal for the city as a whole, outlined the long-range program by means of which it is proposed to completely eliminate the disposal of raw sewage along any of the shores of the city and then described the recent improvements which have been made. Present completed structures provide for elimination of pollution from recreational waters along the North Shore and the Great Highway which is the west shore. The Richmond-Sunset sewage treatment plant was placed in operation in April, 1939. It provides plain subsidence and ocean disposal of the effluent for the sewage from the westerly slope of the city, a residential area with a present population of 150,000 and an estimated future population of 300,000. The plant, designed for 15 million gallons daily average flow, is at present caring for 8 M.G.D.

Situated as it is in the westerly end of beautiful Golden Gate Park, plant design stressed pleasing architecture, adequate ventilation and odor control. Plant facilities include bar screens; grit and grease removal in aerated Imhoff-type separating units; mechanical (paddle) flocculation, with or without chemicals; rectangular subsidence tanks, providing one and one-half hour detention period; prechlorination for odor control and post-chlorination for bacterial disinfection during seasons when the beaches are in use. Sludge is digested, elutriated, dewatered by vacuum filtration after treatment with ferric chloride and used as fertilizer in Golden Gate Park. Average overall removal of 80% suspended solids is being attained and sludge is disposed of at 76% moisture, directly from the vacuum filters.

(1) Chas. H. Lee, Chief of Water Supply and Sanitation, Golden Gate Exposition; (2) Harold Gray, Cons. Engineer, Oakland, and A. P. Banta, Professor, Cal. Tech., Pasadena; (3) Carl Beyers, W. & T. Co., San Francisco (Member of Board of Control, Sewage Wks. Federation)

"Sewage Pumping and Disposal at Treasure Island" by CHARLES H. LEE, Chief, Division of Water Supply and Sanitation, Golden Gate International Exposition, San Francisco.

Mr. Lee touched briefly upon water supply, pest control and garbage collection, and then launched into a detailed description of the sewerage system of the Exposition. Water consumption, he said, originally estimated at 22.9 gallons per capita per day was actually found to vary between 23.1 in May, with an average daily attendance of 37,000, and 21.7 in July with an average daily attendance of 58,000. Garbage amounts to some 40 tons daily. It is disposed of as follows: 10 tons are sold for hog feed at $1.50 per ton and 30 tons of mixed garbage hauled to San Francisco's Bay Shore dump in San Mateo County, for which service the Exposition pays 26 cents per can of 60 lbs. Mosquito larvae propagation in sheltered coves is discouraged with stove-oil and successfully controlled. Carp, planted in one of the artificial lakes, have multiplied so rapidly and stir up the mud so badly as to have become a nuisance. To date over 1500 one-pound carp have been destroyed and while not difficult to catch, it seems impossible to get them all and they reproduce with astonishing rapidity.

Wayland Jones, Sacramento; W. N. Frickstad, Oakland; John A. Clark, Berkeley

Lee stated that in studying the sewerage possibilities for Treasure Island, data from Georgetown, British Guiana, was extensively used. Georgetown is a city of 65,000, in which all sewage is pumped to a single place for disposal. Both in estimated population to be served and in facilities to be afforded, Georgetown and Treasure Island are similar. Following are the essential data relating to the sewerage facilities of the Exposition:

Domestic Water Supply:

Design quantity, all purposes, maximum month, 22.9 gals. per capita per day.

Actual quantity, all purposes, July, 1939, 21.7 gals. per capita per day.

Sewage Collection:

All-pumping system with 14 collecting pumps (5′ x 6′6″ x 10′), 28 pumps, 2 miles of 6 to 16 in. force main.

Source is domestic sewage originating from toilets, drinking fountains and culinary uses.

Design quantities, totals: Maximum month, 6.6 gals. per capita per day; maximum day, 6.1 gals. per capita per day.

Actual quantities, totals: Maximum month, 8-10 gals. per capita per day; maximum day, 6.2 gals. per capita per day.

Total maximum hourly flow per toilet unit, 13.33 g.p.m.

Total maximum hourly flow for Island, 3355 g.p.m.

Check value based upon daily attendance and per capita water consumption less garden watering, etc.:

Total maximum hourly flow for Island, 2800 g.p.m.

For design of pumps and force main used, 3000 g.p.m.

Relative sewage flow at various times in terms of that during maxi-

Golden Gate Park Activated Sludge Plant
Supplies Irrigation Water for the Park

mum hour of maximum day estimated as

Maximum hour of maximum day	100%
Average for maximum day	63%
Maximum hour of average maximum day	53%
Average for average maximum day	33%
Minimum hour of average maximum day	12%

Minimum slopes gravity lines:

6″ pipe	.006
8″ pipe	.004
10″ pipe	.0029

with range of velocity 2.0 to 1.25 ft. per sec.

Sewage Disposal:

Solids broken down by 2-15 inch comminutors, 2.5 m.g.d. rated capacity with head loss not exceeding 6 in.; and disposal by dilution in San Francisco Bay via 18-inch corrugated culvert outfall discharging in 40 ft. of water in East Channel 1000 ft. northeast of Treasure Island.

Designed capacity outfall	3000± g.p.m.
Actual capacity as limited by obstruction	1885 g.p.m.
Maximum discharge from comminutors	2500+ g.p.m.

Average tidal flow through East Channel is 100,000 sec. ft., which for a maximum day's attendance of 332,000 would provide more than 500 times the flow required to maintain a clear and inoffensive water.

Cost:

Gravity collection	$48,000
Force main	19,000
Treatment plant	6,000
Outfall	8,000
Additions	5,000
	$86,000

"Pollution of Navigable Waters or Interstate Streams from the Standpoint of the Federal Government or Army Engineers" by EDWIN C. KELTON, Lt. Col., Corps of Engineers, U. S. Army District Engineer, Los Angeles, California.

In the author's absence the paper was presented by Captain Norman A. Matthias, who stated in brief that the Corps of Engineers, United States Army, was concerned only with the enforcement of existing Federal statutes relating to the pollution of navigable waters; and cited the fact that such pollution has been unlawful since a congressional act of March 3, 1889, Section 13 of which makes it unlawful to place in the navigable waters of the United States any refuse matter of any description, *excepting that flowing from streets and sewers* and passing therefrom in liquid state, whereby navigation shall, or may be impeded or obstructed; or to the placing or deposit of any refuse on the bank of any navigable water or tributary thereto from whence it can float or be washed into the navigable waters by tides, floods or storms. Captain Matthias also cited "The Oil Pollution Act" of 1924, which makes it unlawful to discharge oil into or upon the coastal navigable waters of the United States from any vessel. After defining "Navigable Waters" as navigable in law, which are navigable in fact, Matthias said that the preservation of the purity of these waters is not limited to three or twelve miles but is an assertion of the right of Congress to prohibit the doing of anything tending to destroy the navigable capacity of any of the waters of the United States; that rules are enforced on all American vessels by law and despite the fact that jurisdiction over foreign vessels beyond the three-mile limit has not as yet been settled by treaty, American rules and regulations have been translated into many foreign languages and are enforced by cooperation. He stated that oil must be discharged not less than fifty miles offshore and garbage not less than 18 miles at sea.

The Corps of Engineers, he said, is assisted in the enforcement of Federal pollution laws by the United States Collector of Customs and other revenue officers such as the Coast Guard. Prosecutions are handled by United States District Attorneys.

Captain Matthias said that the State Fish and Game Commission are active in detecting and arresting violators and cooperates fully with the Corps of Engineers and the agencies serve as witnesses for either or both State and Federal cases where such are required. He then cited a number of instances in which violations had been detected, and related many cases in which the fullest and best type of cooperation was being obtained from large corporations and particularly the oil companies. He closed by saying that "It will require continued cooperation of all concerned—vessel operators, shipping interests, and industry in general, especially the personnel 'on the ground' and aboard ship, as well as the state and city agencies and in a small way the public in general—to improve the situation so that conditions are satisfactory. It is the hope of the Corps of Engineers that the necessary steps toward pollution elimination may rapidly be accomplished."

In a discussion of Col. Kelton's paper, A. M. Rawn directed attention to measures which had been presented to the last Congress relating to stream pollution abatement, and briefly discussed recommendations of the Water Pollution Advisory Sub-Committee of the National Resources Committee. He directed

(1) Morris Cohn, San. Engr., Schenectady, N. Y. (came on to talk on garbage grinding and disposal in the sewer system); (2) W. A. Allen, Plant Supt., Pasadena, and Harry Hommon, Sr. Sanitary Engr., U. S. P. H. S., San Francisco; (3) L. L. Cromer and Fred West, Chief Operators of Stockton's plants (North and South respectively); (4) Keeno Fraschina, Asst. Supt., R. R. Sutter, Chief Operating Engr., and Ben Benas, Plant Supt., Richmond-Sunset Plant, San Francisco, (Discussed Operating Problems); (5) Ray R. Ribald, Oakland (Retiring Secretary)

attention to the four general methods of current administrative control over water pollution in the United States as set out by the N.R.C., to-wit:

Common law with respect to riparian ownership, and rights.

Statutory regulations within the States and other political subdivisions.

Interstate pacts.

Federal control of navigable waters.

He stated that it was obvious that Federal legislation, so far enacted, offered little in the way of relief from pollution and contamination of streams, lakes and tidal waters in California or the other States; and, that the regulation of water pollution is now exercised almost wholly by State governments. He then quoted the Resources Committee to the effect that if State laws were strengthened by being drawn to a more uniform pattern, with equal authority enjoyed by all States, with adequate administrative control of pollution, mandatory powers to enforce acts necessary to abate pollution, removal of State limitation on municipal bonding when applied to remedial works ordered by the administrative agency; and authority to organize special sewerage districts, it would be deemed sufficient to empower health authorities to investigate into insanitary conditions and to propose and enforce remedial measures. Rawn then commended the N.R.C. report on stream pollution to the Sewage Works Association members for study and review, stating that he believed the topic should command much attention from the Sewage Works Associations of America and that each, after adequate investigation, should express itself upon the proposals made by the National Resources Committee.

"Pollution of San Francisco Bay, the Ocean Shore and the Effect of Sewage Treatment" by A. B. CROWLEY, Chief Inspector, Division of Industrial Hygiene, City of San Francisco.

The speaker, after describing the general topography and boundaries of San Francisco, stated that at the time the city was established in the middle of the last century, the problem of sewage disposal seemed simple, and was. Sewers were drained directly to tide water and for a number of years such disposal was adequate. A nuisance grew, however, hand in hand with the city, and as late as 1931 all of the sewage of the City and County of San Francisco was being disposed of untreated through 31 outfalls, thirty into the Bay and one out to sea to the west. He then discussed its effect upon shipping resulting from bad odors in the dock front, floating sewage, and hydrogen sulphide gas action on lead paints. He said that despite warnings by the City Health Department, bathers along the north and west shore were defiant and that surf fishermen fished despite raw sewage floating in the surf. In 1931 Dr. Geiger, City Health Officer, started strong influential propaganda telling the truth about what was being discharged on the beaches—and commenced the enforcement of adequate quarantine. Eighteen sampling stations on the City's shores revealed serious contamination.

This information was made public. Eventually the citizens' interest was aroused and in 1934 Messrs. Eddy, Hyde, Kennedy and Reynolds prepared a report. Such, adopted immediately, was put into effect with funds provided by the city and the Federal government and which to date has resulted in the cleanup of a large portion of the shore waters, including all of those areas used for bathing. Mr. Crowly stated that since August 1, 1939, 216 samples taken along the protected shores of the city show a great improvement; that the work of improvement is continuing and that the new Sunset-Richmond sewage disposal works (in service since April, 1939) will be operated to reflect the greatest good on the city's beaches. He closed with the statement that San Francisco was well along the road to complete abatement of shore nuisances and pollution.

"Pollution of Harbors and Streams from the Viewpoint of the Sportsman" by HOWARD VERNON, State Legislator, (Author of "Striped Bass Bill" and other Legislation).

Howard Vernon, whose name is synonymous with sportsmanship in the State of California, stated that while California waters formerly afforded a veritable paradise for anglers, they were not at present so good; that the reasons were the influx of population and lack of thought and pride on the part of some cities. He said it was, in his opinion, as important to keep the State's waters clean as to keep the cities clean; that sanitation and true sportsmanship travel hand in hand; and that the State would never regain its enviable position in the Union until it was perfectly safe for anglers and huntsmen to roam its fields and streams at will and without fear of contaminated and polluted waters. Mr. Vernon stated that some of the most effective remedial measures had been taken by the Army Engineers in the harbor and cited one instance in which a barge owner had been fined $1000 for discharging mixed oil and bilge water into the Bay. Calling attention to a number of specific instances of pollution in the northern waters of the State, Mr. Vernon said he held with Morris Cohn in a recent statement to the effect that those who contribute to the pollution of the otherwise pure waters of the United States should be compelled to take a dip in their own sewage! Mr. Vernon said he hoped the efforts of such organizations as the California Sewage Works Association would result in better understanding by the public of the hazards of stream pollution and in more adequate laws to strengthen the hand of State officials in enforcing such measures.

The Editor's Comments

"CAVEAT EMPTOR"—

PAPERS read before professional groups and articles appearing in technical publications abound in information concerning successful applications of principles, processes and equipment. Rarely is it that such professional groups or readers of technical publications are told of principles, processes or equipment that have been tried and found wanting. That is, successes are heard from in abundance but what is likewise of helpfulness in the development of any art, the failures, are only whispered around.

As too frequently happens, a writer tells of experiences and results within a period of demonstration which is too brief for rendering sound judgment on the development in question. Then, as time goes on, difficulties begin to appear and failures upset the early assumptions and conclusions of the author. Do we later read of such difficulties and disappointments, or that the scheme by test of time having been found wanting, has been abandoned for something different, or has had to be materially modified? Only too rarely have we such an opportunity. This is, to our thinking, unfortunate.

This writer has read papers, or seen a report of some discussion presented in a meeting, which related how this or that was being accomplished at a certain plant, giving the advantages of such method, etc. As a matter of fact, through a visit to that plant, or in conversation with the author of the original article, it had been learned some time previously by the writer that the scheme referred to (published) had been found less satisfactory than early experiences indicated, and had been abandoned. Had this information appeared in print? No!

More serious than the lack of published shortcomings of methods of procedure, or process regulation, is the lack of published fact concerning the shortcomings or failures of newly introduced equipment of costly nature. Such equipment frequently receives a glowing appraisal at the hands of some enthusiastic purchaser before time has tested the dependability of such equipment under varying conditions, some of which (in sewage treatment especially) may be seasonal.

Even editors have, at times, been so thoroughly "sold" on principles underlying the application or workings of a new piece of equipment or some plant design feature, and early results therefrom at a single plant, as to give prominent space to the development. He then expects, for a year, to run the promised follow-up article planned to reveal the first year's operating results and cost data. The year rolls past and no such paper is received. Suspicions begin to creep over him that all is not well with the equipment, process, or design features publicized. Then the reminder goes out to the effect that the publication schedule shows that the time has arrived for the article "promised our readers" to reveal 12 months of operating experiences. The reply received is not encouraging. It states that when the unusual conditions clear up or the peculiar difficulties are smoothed out the data will be representative and that the article should, accordingly, be delayed. Experience has revealed that such an explanation is tantamount to saying, "If we told the truth it would do nobody any good."

Now, this may be a fact, but it is our belief that the professional spirit in such instances should outweigh that of hiding a truth in order to protect an individual or a purveyor of equipment. At best, it is false protection to withhold facts concerning failures that have proven uncorrectable after reasonable periods. In protecting a few the many may be allowed to suffer similar consequences, resulting in public losses.

As publishers, we have had some interesting experiences which probably indicate why more statements concerning equipment weaknesses or failures do not get into print. As the result of printing an author's (or speaker's) remarks, as made, we have been threatened with cancellations of advertisers' contracts; have been told that we could never expect advertising from one manufacturer because of statements printed which proved derogoratory to the type of equipment produced by his company; have been threatened with a suit for printing a statement of fact by a speaker who revealed weaknesses in a certain type of equipment finally abandoned. Worst of all, we have been given to understannd that advertising would follow a submitted article, patently by a ghost writer, which made much of the apparent failure of a material supplied by a competitive industry. Fortunately we knew what the true facts in the case were and could prove the article misleading.

Whatever may be responsible, the dissemination of so little of true fact does not lead to soundness of professional policy and practise. Moreover, a lack of knowledge of failures may prove decidedly costly in respect to engineer prestige, reputation of designers, and in funds of the community or utility served.

All of this leads us to commend Charles R. Cox, of the N. Y. State Department of Health, for the paper which he recently presented before the New England Water Works Association. His paper was, as he explained, "different" and is one of those rare and frank discussions of problems unsuccessfully solved, and certain equipment shortcomings. A digest of Mr. Cox's paper, revealing "Significant Experiences" appears in our last issue. It might have been captioned *"Caveat Emptor,"* in that purchasers of the equipment which under other conditions and circumstances probably would have proved satisfactory, but which failed in these specific instances for reasons cited, paid rather heavily in the end. Mr. Cox's paper dealt with failures of water treatment devices and processes. We wish that someone would undertake a like job in respect to discussing failures in the sewage field. We frankly believe that those same state authorities who are responsible for approving the design of plants, and equipment employed, also have a complimentary duty to perform. Such duty is the systematic reviewing of failures in the manner so fairly done by Mr. Cox.

Caveat Emptor (let the buyers beware), a phrase employed in legal terminology should be if it is not already outmoded. However, it is a wise purchaser who knows what *not to buy* in the water works and sewerage fields. It is a *wiser* purveyor who knows what *not to sell,* where likelihood of failure is a possibility.

L. H. Enslow

ON GUARD

At the entrance to the modern sewage treatment plant stands a SENTINEL protecting mechanical equipment and piping against trouble. Coarse matter in sewage causes mechanical equipment to bind and piping to clog. The COMMINUTOR is the sentinel guarding against this. It cuts into small pieces all coarse material in sewage that would cause trouble. It eliminates the necessity of screening out the coarse material and the disposal of the filthy screenings. It protects the operator against infections, because he does not have to handle the filthy screenings.

Bulletin 185 Gives Complete Information on Comminutors

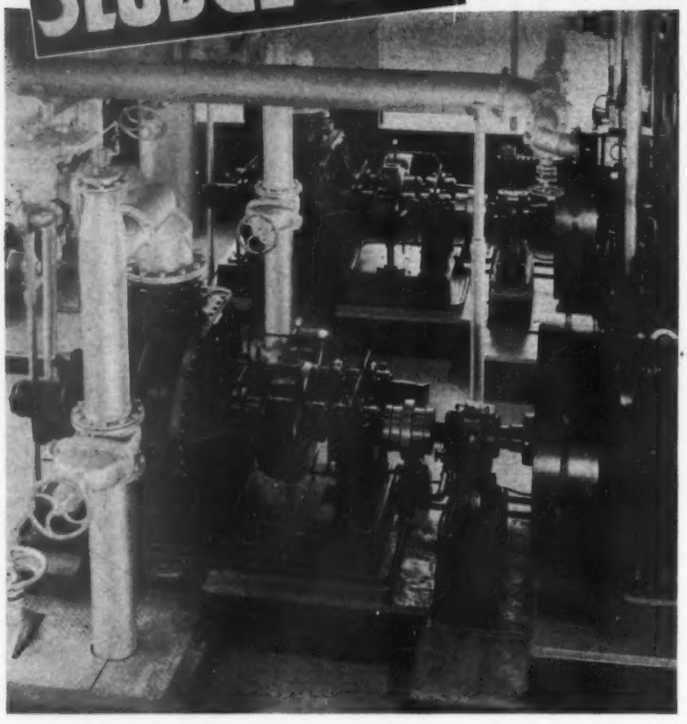
CHICAGO PUMP CO. SEWAGE EQUIPMENT DIVISION

2336 Wolfram Street, CHICAGO, ILL.
Phone BRUnswick 4110

VACUUM – CONDENSATION – CIRCULATING – BILGE
FIRE – HOUSE – SEWAGE – SCRU-PELLER PUMPS
AERATORS – COMMINUTORS – SAMPLERS

REPRESENTATIVES THROUGHOUT THE UNITED STATES AND FOREIGN COUNTRIES

Use SLUDGE GAS to deliver LOW COST AIR



Sludge gas can be profitably utilized as fuel in gas engines *direct connected* to Roots-Connersville Rotary Positive Blowers.

In some plants sludge gas engine driven blowers supply all air needed. The activated sludge type of plant at Topeka, whose blowers are shown here, is a good example. Gas engines are sometimes supplemented by electric motor driven blowers for use *only* when air demand exceeds the capacity of the sludge gas engine driven blowers.

Where "R-C" Blowers were originally motor driven they may be converted to gas engine drive. The resultant saving in power costs frequently pays the entire cost of the change-over in less than two years.

Roots
CONNERSVILLE
BLOWER CORP.
911 MOUNT AVE.
CONNERSVILLE INDIANA

MODERN TRANSPORTATION *Streamlined!*

TO REDUCE FRICTION

Just as the Streamlining of modern trains minimizes air resistance with a corresponding increase in speed, so the Smooth, Unbroken Interior Surfaces of Lock Joint Concrete Pipe Lines reduce water friction to a minimum with a corresponding increase in Carrying Capacity.

Lock Joint Pipe's Greater Carrying Capacity makes possible a smaller initial investment per million gallons of flow.

LOCK JOINT *Reinforced Concrete* PRESSURE PIPE

LOCK JOINT PIPE CO. Established 1905 AMPERE, N. J.

EQUIPMENT NEWS

Multi-Stage Slo-Mixing Offered by Chain Belt

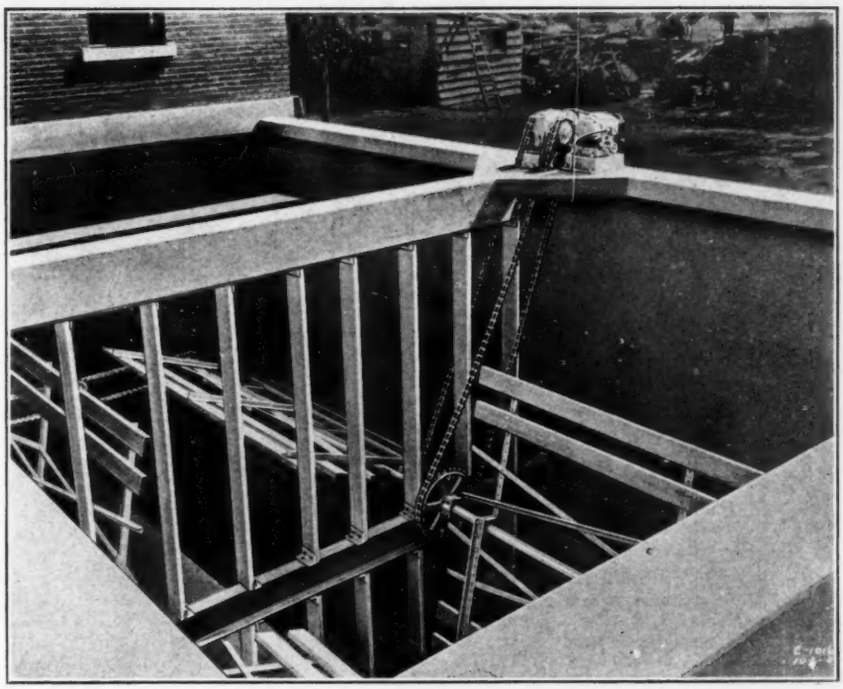
● Recognizing the advantages of multi-stage flocculation, Chain Belt Co. has developed the Rex "Slo-Mixer" for sewage and water treatment plants.

The Rex "Slo-Mixer" obtains multi-stage slow-mixing by progressively decreasing either the paddle speed or paddle area or both. Paddles are installed with direction of rotation at right angles to the flow of liquid. This arrangement coupled with the use of an ingenious baffle arrangement (see cut) assures positive mixing, the elimination of short circuiting, and a minimum of power consumption. Operating experiences have adequately proven the value of such flocculating equipment in saving chemicals and increasing plant efficiencies.

Several possible drive arrangements are available with the "Slo-Mixer", allowing the selection of the most economical and efficient drive for each application. A variable speed unit providing a 3 to 1 range is usually incorporated in the drive to provide greater flexibility, and allows the operator to keep the equipment in step with the flow and change in composition of the liquid being flocculated.

Rex Slo-Mixers may be installed in existing basins, or any portion of existing sedimentation basins may readily be converted into slo-mixing basins. For existing plants and new installations an economical arrangement may be worked out for the Slo-Mixers alone or in combination with mechanical clarifiers in the sedimentation basins.

For further details, write the Chain Belt Company, 1610 West Bruce St., Milwaukee, Wis.



Rex "Slo-Mixer"

This design has twin paddles, with drive at center of shaft. Other types provide three stages, with single line or twin paddles.

Dust Tight Storage Control With Tellevel

● The Stephens-Adamson "TELLEVEL," is a device which controls input of dry pulverant materials into bins and hoppers; or liquids into tanks or reservoirs.

The "TELLEVEL" is positive in operation, since individual units transmit level signals, or sends the impulse which starts and stops filling operations automatically. It will start pumps or conveyors; will open and close valves or gates; or perform like duties, such as opening bypasses to prevent flooding at plants, etc.

"TELLEVELS" are of the simplest possible construction, involving dust and water tight housing of the tipping mercury switches, actuated by the float which may tip in any one of the 360 degrees from vertical. The flexing rubber diaphragm through which the float rod passes renders the housing water and dust tight. The price seems reasonable enough.

For descriptive leaflet, write Stephens-Adamson Mfg. Co., Aurora, Ill.

THE *Bailey Synchro-Meter* GIVES YOU *Flexibility* IN METERING APPLICATIONS

● This meter panel includes both direct mechanically operated Fluid Meters and Bailey Synchro-Meters, which are electrically operated by remote transmitters.

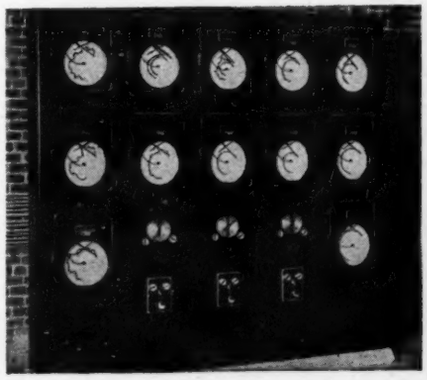
Wherever you have need for a central meter panel incorporating both mechanically and electrically operated Fluid Meters, it is possible to maintain uniformity and neatness by employing this system of transmitting meter and recorder readings.

Readings of flow, pressure, temperature, liquid level and other factors are accurately and quickly transmitted from out-of-the-way places to the receiving indicator, recorder or integrator by the Bailey Synchro-Meter.

This electrical mechanism which is completely described and illustrated in Bulletin No. 194-A, can also be used to eliminate the necessity of running high pressure piping up to meter and control panels.

Write for your copy of this new Bulletin.

MU-17



BAILEY METER • COMPANY •

1072 Ivanhoe Road, Cleveland, Ohio

BAILEY METER COMPANY LTD., MONTREAL

FERRIC
ISCO
CHLORIDE

For Sewage and Water Treatment
have you tried

• ISCO •

Ferric Chloride . . . . .
SOLUTION or CRYSTAL?

FOR SLUDGE CONDITIONING—Ferric Chloride is accepted as the agent most efficient from the standpoint of performance and cost.

FOR COAGULATING SEWAGE—Ferric Chloride provides an inexpensive and effective method of dealing with plant overloads.

FOR WATER PURIFICATION—Ferric Chloride is an economical and practical coagulant, and gives quick-forming, fast-setting floc. Write

INNIS, SPEIDEN & CO.
117 LIBERTY STREET, NEW YORK, N. Y.
Chicago Cleveland Boston
Philadelphia Gloversville, N. Y.

HELP WANTED

Wanted: Sewage Plant Superintendent to supervise operations and do analytical work. Salary $150.00 a month for half time. Other supervisory work available to increase income. Outline qualifications by letter to H. C. Y., % "Water Works and Sewerage," 155 East 44th Street, N. Y. C.

Wanted, young chemical engineer, several years' experience in municipal water treatment, softening, filtration, corrosion control, for development, technical sales and service with organization specializing in water conditioning. Must be willing to travel. Please send photo with letter describing training, experience, special qualifications to Box 300, Water Works and Sewerage, 330 South Wells St., Chicago, Ill.

POSITION WANTED

By Chemist—Operating water or sewage treatment plant or selling water works and sewerage chemicals or equipment. B.S. and M.S. in chemistry. Four and one-half years' experience as Sanitary Chemist in State Health Department. Address "D. J. J.," % Water Works & Sewerage, 155 East 44th St., New York City.

By Engineer—Const. Supt.; Graduate Civil Engineer, 20 years' experience in designing, estimating, sewage disposal, water and power supply, roads and industrial plants. Available immediately.—Address—"H. A. P.," care Water Works & Sewerage, 155 E. 44th St., New York City.

A Sight Glass for Pipe Line Flow Inspection

● There are many applications for a visible-flow fitting such as that developed by Cochrane Corporation, to facilitate the observation of sludge or liquid blow-off from various operations and processes. The closed fitting, equipped with sight glasses, permits discharge of the sludge or liquid under pressures up to 125 pounds where advantageous.

The Cochrane Sight Glass is available in six sizes for 2½, 3, 4, 5, 6. and 8 in. lines. Body is of cast iron and the window frame is of steel. Windows are made of Pyrex glass. The Sight Glass fitting is flanged for installation in the line and all sizes measure 13¼ in. between finished flange surfaces. Windows are 4¼ in. in diameter for all sizes.

For Data Sheet 2945 giving details, write Cochrane Corporation, 17th St. & Allegheny Avenue, Philadelphia, Pa.

Coupling Leak Repair Clamp

● For quickly stopping leaks through threads of screw couplings, Dresser Manufacturing Company is offering its style 41 repair clamp in sizes from 4½" to 12" ID inclusive. A smaller clamp of the same design, with malleable followers instead of steel, is known as style 4, and comes in sizes ¾" to 4" ID inclusive.

The collar clamp consists of the few simple parts, which are quickly assembled with only one tool—a wrench. Advantages claimed for the Dresser collar clamp are simplicity, speed, efficiency, and permanent tightness due to the rubber seal gasket. The installation is made without interrupting service and requires no skill.

Literature descriptive of the Dresser collar clamp is available from Dresser Mfg. Co., Bradford, Pa.

New Valve Operating Unit

A new valve operating unit for use in pumping stations, filtration plants and on distribution systems, in sewage disposal plants, has just been announced by Cutler-Hammer, Inc., of Milwaukee.

Intended for electric motor operation of gate and globe valves or sluice gates, the new C-H No. 816 Valve Operating Unit provides a controlled thrust action directly on the valve stem, thus achieving a new standard of accuracy in opening and closing the valve.

The dust tight, weather proof unit is bolted on top of the valve yoke. It consists essentially of:

(1) Thrust springs, which compensate for the expansion and contraction of the valve stem resulting from temperature changes, assure a complete and accurate functioning of the valve.

(2) High torque (reversible) motor, whose high speed rotating energy unseats the tightest valve.

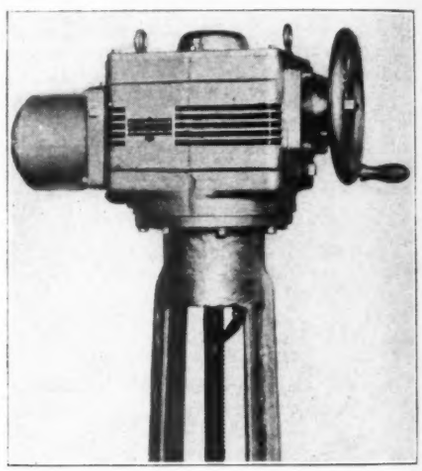
(3) Simple jaw clutch for coupling the operating unit to the yoke nut.

(4) Gear reduction—oil immersed for complete lubrication.

(5) Thrust limit switch controls seating of the valve without jamming or damage.

(6) Position limit switch stops the operator in open valve position.

(7) Handwheel for manual operation—is normally disengaged and does not turn during motor operation.



This new C-H Valve Operating Unit, Bulletin 816, can be obtained in suitable sizes, with a controlling thrust of only a few pounds, or in larger sizes with a maximum thrust of 400,000 pounds. It is designed for applications requiring a slow throttling gate speed, or for emergency quick closing speed up to 80 inches per minute.

For Bulletin 816 which gives complete details concerning this new C-H Valve Operating Unit, write Cutler-Hammer, Inc., Milwaukee, Wis.

WITH THE MANUFACTURERS

Patton Made Sales Manager For Alco Products

C. S. Patton

● C. S. Patton has recently been made Sales Manager of the Alco Products Division of the American Locomotive Co., and takes charge of the sale of Steel Water Pipe, Heat Exchangers, Condensers, Feed Water Heaters, Evaporators, Fabricated Plate Work, and allied lines.

"Pat" graduated from Cornell with the degree of Mechanical Engineer in 1918. In 1929 he took charge of the sales of fabricated plate work for the Heat Transfer Products Co., which company was acquired by the American Locomotive Co. and expanded into its Alco Products Division. Of this Division, Mr. Patton was made Manager of Equipment Sales, which position he has held up to his present appointment.

Clay Pipe Association Employs Cresswell as Promotion Engineer

● Fred S. Cresswell, Engineer, has resigned his position held in P.W.A. since 1933 to accept a post as promotion engineer for the recently formed Clay Sewer Pipe Association.

Mr. Cresswell will direct promotion work for the Association in Virginia, West Virginia, and Maryland, and in Washington, D. C., where offices have been opened in the Munsey Building.

The Clay Sewer Pipe Association was founded in February, 1939, to promote the use of vitrified clay pipe for sewerage and highway construction.

Armco Culvert Ass'n. Adopts New Name

● Changing trends in its business has led the Armco Culvert Mfgrs. Association, Middletown, Ohio, to adopt the new name of ARMCO DRAINAGE PRODUCTS ASSOCIATION.

When the Association was formed (1904) ARMCO Ingot Iron Culvert pipe was the principal product manufactured by its members. However, during the past ten years or more the use of perforated corrugated pipe for subdrains, the development of asbestos-bonded paved-invert pipe for sewers, spiral welded steel water pipes, the introduction of multi plate pipe and arches for small bridges, and the increasing use of drainage gates for levees and dams have made culvert pipe only one part of the business.

Other products manufactured or sold by the member companies of the Armco Drainage Products Ass'n. include metal retaining walls, culvert headwalls, flumes, sheet piling and tunnel liner plates.

Officers of the Association are: W. H. O'Neall, pres.; H. W. Porce, vice-pres.; M. F. Shelt, sec.-treas. The headquarters staff at Middletown is headed by S. R. Ives, vice-pres. and general manager; M. C. Patton, asst. manager; G. E. Shafer, chief engineer, and W. H. Spindler, publicity manager.

G. S. Crane Becomes Vice-President of Cutler-Hammer

G. S. Crane

● Cutler-Hammer Inc., has announced the appointment of G. S. Crane as Vice-President in Charge of Sales and Engineering.

For 29 years Mr. Crane has served Cutler-Hammer in its Engineering and Sales Departments. In this present promotion, from his position in Charge of Sales, he assumes supervision of all developmental and engineering work for Cutler-Hammer.

Mr. Crane is well known for his work in the electrical field. He is at present Chairman of the Advisory Committee of the National Electrical Mfgrs. Assn., and was recently elected a member of its Board of Governors.

Largest Ozone Installation for Whiting, Ind.

● Ozone Processes, Inc., Philadelphia, Pa., has been awarded a contract to supply and install the necessary equipment to ozonate the entire water supply of Whiting, Indiana, averaging 3 million gallons daily. The equipment will have a daily capacity of 45 pounds of ozone, providing an ample reserve to meet the ozone demand of the Whiting water, as determined by pilot plant tests operated by Ozone Processes, Inc.

The Whiting installation, expected to be in operation early in 1940, will be the largest operating plant in America.

Caterpillar's "Vic" Wallace Becomes Manager of Western Sales

● Caterpillar Tractor Co. announces the appointment of V. H. ("Vic") Wallace as Western Sales Manager, to succeed the late H. H. Chambers.

In 1927 Mr. Wallace became affiliated with Caterpillar's Advertising Department as assistant manager. In January, 1933, he was transferred to the Western Sales Division as District Representative. In 1938 his prowess was rewarded in his appointment as Assistant Sales Manager, and now becomes Manager of Western Sales, with headquarters in San Leandro, Calif.

SAVE TIME and TROUBLE

with this QUICKER HEALING Pipe Jointing Compound

Initial leakage heals quickly, Trenches need not stay open for days. Traffic hazards and inconvenience are quickly ended . . . all this when you joint your bell and spigot lines with Tegul-MINERALEAD ● Joints are easily made and permanently tight. No skilled labor, caulking or deep bell holes needed ● Tegul-MINERALEAD comes in 10 lb. ingots, easy to handle, ship and store ● No possibility of composition changing under jolting in transit ● No fear of rain, snow or flood, if stored in the open ● For more information, write The ATLAS MINERAL Products Company of Penna., Mertztown, Pennsylvania.

Tegul-MINERALEAD

MULTI-ZONE FURNACES

CONSTRUCT - DESIGN - SUPERVISE - UNDERPINNING AND FOUNDATION CO. - 155 EAST 44TH ST. - NEW YORK

For Incineration of SEWAGE SLUDGE, SCREENINGS, GROUND GARBAGE

Operation is without auxiliary fuel—odorless!

- SEPARATE DRYING AND INCINERATING ZONE.
- FLEXIBLE AND AUTOMATIC TEMPERATURE CONTROL.
- ALL GASES COMPLETELY DEODORIZED.
- RESIDUE UNIFORM, INERT, NON-OFFENSIVE ASH.
- OPERATING RESULTS POSITIVE AND LOW IN COST.

INSTALLATIONS AT
Niagara Falls, N. Y.
Milwaukee, Wis.
Lansing, Mich.
Raritan, N. J.

MULTI-ZONE FURNACES

Embody Greatly Improved Principles of Multiple Hearth Operation

UNDERPINNING & FOUNDATION CO., Inc.
155 East 44th St.
NEW YORK, N. Y.

Accuracy

The primary requirement of any metering device is its ability to accurately record and totalize flow rates over a wide range and with prompt response to any change in rate.

Only when all characteristics of both primary and secondary devices are known and properly related can this be done.

Purchasers of Simplex Venturi Tubes and Meters receive, in addition to mere equipment, the results of over 35 years continued studies and research on both the primary device and the meter register. With this knowledge incorporated in the equipment design, accuracies of any Simplex installation satisfy the most demanding requirements of designing and operating engineers.

Let Simplex Engineers show you WHY and HOW you can benefit.

SIMPLEX
VALVE & METER
COMPANY

6743 UPLAND STREET • PHILADELPHIA, PA.

MEETINGS SCHEDULED

Dec. 13—AUBURN, MAINE
Maine Water Utilities Association. Secretary, Earle A. Tarr, Supt. Winthrop Water District, Winthrop, Maine.

Jan. 17-19, 1940—NEW YORK CITY, N. Y. (Engineering Societies Building)
American Society Civil Engineers. Annual Meeting. Secretary, George T. Seabury, 33 West 39th St., New York City.
(Jan. 19—Sessions and Joint Dinner of the Sanitary Engineering Division and N. Y. State Sewage Works Ass'n.)

Jan. 19-20—NEW YORK CITY, N. Y. (Hotel McAlpin)
New York State Sewage Works Ass'n. Sec'y, A. S. Bedell, State Board of Health, Albany, N. Y.
(Jan. 19—Joint Annual Dinner with San. Eng. Div. of A.S.C.E.)
(Jan. 20—Joint inspection trip with San. Eng. Div. of A.S.C.E.)

Mar. 4-8—DETROIT, MICH.
American Society of Testing Materials. Sec.-Treas., C. L. Warwick, 260 So. Broad Street, Philadelphia, Pa.

Mar. 18-20—BIRMINGHAM, ALA.
Southeastern Section A.W.W.A. Sec.-Treas., B. P. Rice, Room 425, State Office Bldg., Columbia, S. C.

Mar. 20-22—TRENTON, N. J .(Hotel Stacey Trent)
New Jersey Sewage Works Association, (Silver Anniversary). Sec.-Treas., Paul Molitor, Jr., P. O. Box 374, Morristown, N. J.

Mar. 27-29—(Place not selected)
Canadian Section A.W.W.A. Secretary, A. E. Berry, Ontario Dept. of Health, Toronto, Ont.

Apr. 8-10—LEXINGTON, KY.
Kentucky-Tennessee Section A.W.W.A. Secretary, H. D. Schmidt, State Dept. of Health, Nashville, Tenn.

Apr. 11-12—WEST LAFAYETTE, IND. (Purdue University)
Indiana Section A.W.W.A. Secretary, H. G. Horstman, 603 Traction Terminal Bldg., Indianapolis, Ind.

Apr. 21-25—KANSAS CITY, MO. (Headquarters Hotels—The Phillips, The President and The Muehlebach)
American Water Works Association Annual Convention. Secretary, Harry E. Jordan, 22 East 40th St., New York City, N. Y.

May 9-10—AKRON, OHIO
Ohio Section A.W.W.A. Secretary, T. R. Lathrop, State Dept. of Health, Columbus, Ohio.

May 9-11—PORTLAND, OREGON
Pacific Northwest Section A.W.W.A. Secretary, Fred Merryfield, Oregon State College, Corvallis, Oregon.

May 16-18—(Place not selected)
Florida Section A.W.W.A. Secretary, A. P. Black, University of Florida, Gainesville, Fla.

May 22-24—CHICAGO, ILL. (Congress Hotel)
Illinois Section A.W.W.A. Secretary, H. E. Hudson, Jr., 6843 Oglesby Ave., Chicago, Ill.

June 24-26—STATE COLLEGE, PA. (Nittany Lion Inn & Dormitories)
Pennsylvania Water Works Operators' Association. Annual Convention. Sec.-Treas., I. M. Glace, Consulting Engineer, 22 So. 22nd St., Harrisburg, Pa.

June 26-28—STATE COLLEGE, PA. (Nittany Lion Inn & Dormitories)
Pennsylvania Sewage Works Association. Sec.-Treas., L. D. Matter, Distr. Engr., Kirby Health Center, Wilkes Barre, Pa.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of Water Works and Sewerage, published Monthly at Chicago, Illinois for October 1, 1939.

State of Illinois, County of Cook, ss.

Before me a Notary Public in and for the State and county aforesaid, personally appeared Edward S. Gillette, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Water Works and Sewerage and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher—Gillette Publishing Co., 330 S. Wells St., Chicago, Ill.
Editor—L. H. Enslow, 155 E. 44th St., New York, N. Y.
Managing Editor—John Cecil Black, 330 So Wells St., Chicago, Ill.
Business Manager—E. S. Gillette, 330 S. Wells St., Chicago, Ill.
2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)
Gillette Publishing Company, 330 So. Wells St., Chicago, Ill.
H. P. Gillette, 330 So. Wells St., Chicago, Ill.
Winifred Gillette, 1125 Oak Grove Ave., San Marino, Calif.
Mrs. R. W. Hume, 303 So. Stone Ave., La Grange, Ill.
Provident Trust Company, 17th and Chestnut Sts., Philadelphia, Pa.
Louise Forsythe, 13 E. Windemere Terrace, Lansdowne, Pa.
La Verne Louer Hellyer, Ambassador Hotel, Chicago, Ill.
L. H. Enslow, 155 E. 44th St., New York, N. Y.
3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None
4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.
5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is ..... (This information is required from daily publications only.)

EDWARD S. GILLETTE,
Business Manager.

Sworn to and subscribed before me this 29th day of September, 1939.
(Seal)

KITTIE C. WOULFE,
Notary Public.
(My commission expires Feb. 8th, 1942.)

CATALOGS AND LITERATURE

"Pipe Progress in Panorama"—is interestingly presented in the October issue of *Pipe Progress,* which pictorially presents ACIPCO developments of recent years in Panorama. These start with the development of the Mono-Cast Centrifugal Process, employing sand moulds, now producing pipes up to 48-inch diameter with inherent characteristics resulting from the method. Then comes the development of "Enameline" lined pipes; the "Doublex-Simplex Mechanical Joint"; the "Molox Ball and Socket Joint" for submarine construction; then the less well known and newest "Boltless Simplex Joint", which is a flexible rubber packed joint; the more recent "Armored Mono-Cast Pipes" for severe soil conditions. To many the least known development (1937) is the economical light weight Mono-Cast "Roll-On-Rubber-Ring Joint Pipe", which provides flexible joints simply slipped together with a ring of rubber followed by jute or hemp and finally packed with "Tuf-flex", a bituminous compound that remains soft and pliable. (The rubber-ring joints may be made with cement, joint compounds or lead, if less flexibility is satisfactory.) Readers will find October *"Pipe Progress" interesting.* If you would like a well done, illuminating monthly publication, get on the list of American Cast Iron Pipe Company, Birmingham, Ala.

"A. P. Smith's New General Catalog"—If we are any good at figures, A. P. Smith Manufacturing Company of East Orange, N. J., is due to celebrate a Golden Anniversary. (This much we deduct from the firm's slogan "Since 1889—A Symbol of Water Works Leadership.") Possibly the new Complete A.P.S. General

(Continued)

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Ferrisul is saving us $2,500 a year... and new equipment needed to handle it cost only $140.
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These actual statements are typical of the words of scores of waterworks and sewage plant officials who have saved money by using Ferrisul as a coagulant. Frequently the savings of a year, or a single season, are many times the cost of new equipment needed for Ferrisul's application. Ferrisul is easy to handle and store . . . simple to apply. It is an anhydrous ferric sulfate which quickly forms a rapid-settling, stable floc over the entire pH range above 3.5. It is effective in all seasons of the year.

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for water and sewage treatment

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Write for Bulletin 205-A.

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Catalog No. 39, bearing the company seal in embossed gold on rich black morocco finished binding, is a silent reminder of the year denoted. This complete catalog is of handy 9 x 6 inch size and contains 240 pages of profusely illustrated A.P.S. equipment which includes Valves (gate, check, tapping,—hand, hydraulic or electric operated); Valve Boxes; Hydrants (fire, sprinkler, flush); Meters; Brass Goods (fittings and specialties); Machines (tapping, pipe cutting, valve inserting, drilling, corporation tapping); Repair Sleeves; Floor Stands and Indicator Posts; etc. Valves and Hydrants are presented in every detail, with directions for ordering. For the famed Smith Tapping Machines, Valves and Sleeves —27 pages are required; for small Brass Goods—25 pages; for Federal Meters—54 pages. It's a catalog that every water utility office should have on hand. It's new —it's complete. Address A. P. Smith Mfg. Co., East Orange, N. J.

"The 18-Year Story of Lock Joint Pipe"—comes in the form of a "Yesterday and Today" story covering Denver's 54 inch line of Lock Joint Cement Pipe. Amongst the earliest lines of this type of pipe laid (1920) tests made in 1925 by Uncle Sam's Engineer Scobey revealed for this 7.2 mile line a "C" value of 146. Now (14 years later) Engineer Scobey, repeating his tests to a detail, finds that Denver still has not only 100% of the pipe line capacity purchased in 1920—it has 100+% after these 18 years of service. This and other similar lines in Denver yielded under Mr. Scobey's tests a "C" value of *147*. About this, Denver authorities must feel happy because they now have 55 miles of this same pipe. If interested, write for "The Denver Story." It carries revealing pictures of the interior of this 18-year-old line, which to all appearances is brand new. Address, Lock Joint Pipe Co., Ampere, N. J.

"Atlas Mineral Products", including pipe jointing compounds (water and sewer), protective linings and coating (cements and plastics), acid-proof brick and cement, are presented in a new catalog from Atlas Mineral Products Co. Complete properties and specifications are given for each product and installation illustrations picture principal applications of each material. At the end is a useful guide of tabulated data, factors, etc., to serve in making up estimates of acid-proof mortars for masonry work, and jointing materials for water and sewer lines. In designing modern sewage works, involving tighter sewers and more acid-proof construction at plants, the new Atlas Catalog will prove of material aid. For a copy, write Atlas Mineral Products Co., Mertztown, Pa.

"Centrifugal Blowers", in single and multi-stage models, are described and illustrated in a new bulletin of 20 pages from Roots-Connerville Blower Corporation. These air blowers, extensively used in industrial plants since 1930, have more recently been employed in sewage treatment plants. The bulletin pictures in detail the several types offered and presents pressure-volume curves and pertinent information regarding operating characteristics. For a copy of No. 125-B11 or their better known Rotary Blower bulletin, write Roots-Connersville Blower Corp., Connersville, Indiana.

"An Improved Decanting Feeder"—mislabeled by Permutit Co. as an "Electro-Chemical Feed" is none the less a valuable automatic decanting type of feeder, especially suitable for lime slurry and other suspensions. The "Electro" part of the feeder is a form of telemetering wherein the metered water flow (rate) is electrically transmitted to a fractional horse power motor. At 15

second intervals the motor, through a gear driven drum, allows a solution skimming pipe within the tank to drop at a rate proportional to the volume of water, sewage or sludge passing through the metering element. An agitator maintains the suspension at constant chemical strength. The dosage is varied by a simple dial (cam) adjustment, varying the number of teeth engaged by the pawl per revolution of the gear. An ingenious pantographic arrangement of swing joints and pipes cause the draw-off head in the tank to drop in essentially a perpendicular line rather than an arc. Where pumping of the chemical feed is necessary a novel pump is supplied. For Bul. No. 2233 describing the Electro Chemical Feeder" write the Permutit Co., 330 W. 42nd St., New York City.

"The Arrowhead Hand Book"—is a recent brochure being offered engineers concerned with the use and adaptation of gratings, as somethings of a gratings handbook. The Type H. Arrowhead Grating, featured as the only grating of its kind, is being increasingly employed in constructing entire floors of these gratings, which are designed as truss members for rigidity, strength and stability to carry live or dead loads. The exclusive design employed makes for a grating of less weight than the regular flat type gratings, which Arrowhead also supplies. Tables covering spans up to 15 feet, indicate safe loadings for various spans and weights of gratings. For this "Handbook on Gratings," write Arrowhead Iron Works, 421-431 West 5th Street, Kansas City, Mo.

"Copper Sulphate in Water Treatment" is covered in a bulletin from Tennessee Corporation of Atlanta, Ga., which features the continuous feeding process of copper sulphate treatment for algae control. Illustrated is the simple continuous solution feeder developed at the Atlanta Filter Plant which involves feeding of a saturated solution, the dosage being varied by changing rates of dissolving water flow through the copper sulphate crystals in the saturation chamber. A graph devised for converting rates of dissolving water flow into pounds of copper sulphate dissolved (fed), serves as a guide in operating the saturation type feeder. Dosages required to destroy various algae forms are tabulated as are those amounts dangerous to the more common varieties of fish. In addition, experiences with copper-sulphate added to sewers for killing tree roots are given. The booklet also draws attention to the corporation's new ferric coagulant (sulphate) known as "Ferri-Floc." For a copy of "Copper Sulphate in Water Plants" write Tennessee Corp., Atlanta, Ga.

"NI-RESIST in Sewage Treatment" is the caption of a brochure from International Nickel Company. It sets forth the composition and properties of the nickel-cast-iron alloy "NI-RESIST" as a material to withstand corrosive atmospheres and liquids in sewers, pump stations and treatment plants. Results of comparative corrosion tests made at treatment plants (graphically presented), indicate "NI-RESIST" to be superior to cast-iron, steel or copper, and approaching the resistance of the much more expensive copper-nickel-alloy Monel Metal. For a copy of this brochure write The International Nickel Co., 67 Wall Street, New York City.

"Stopping Leaks With Colclay"—has been the happy experience of some engineers who have used American Colloid Company's "Volclay," which is a high-colloidal processed Bentonite. The story of how the clay-sand slurry was pumped in as a grout to stop

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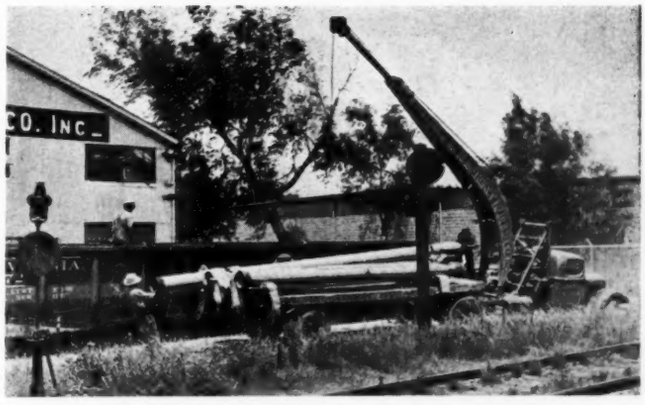

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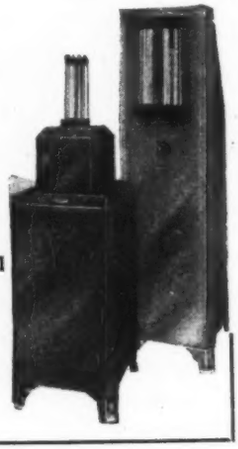
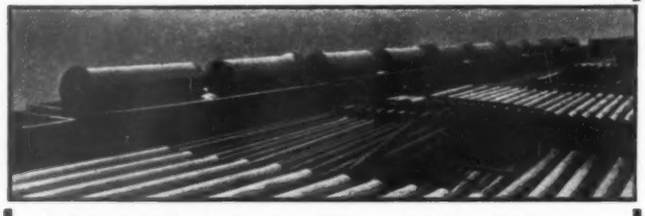
Write for Bulletin 1004

Left: Tower Model

Right: Cabinet Model



93,100 FEET OF 48" MONO-CAST ENAMELINE PIPE ORDERED BY Wichita, Kansas



48" Mono-Cast Enameline Pipe loaded for shipment to Wichita, Kan.

Indicative of Acipco's extensive facilities for handling large orders for large pipe, was the award early in October of an order for approximately 33 miles of Mono-Cast Enameline Pipe to be used in a new water supply line for Wichita, Kan. Included in this order were: 93,100 ft. of 48", 27,200 ft, of 42", 8,200 ft. of 36", 7,300 ft. of 24", 5,300 ft. of 20", and 25,400 ft. of 14" pipe. More than 2,000,000 feet of Mono-Cast Enameline Pipe are now giving highly satisfactory service. Write for literature.

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infiltration into sewers and tunnels, and applied in another way to stop leakage from reservoirs, is told in the form of testimonials, reports and letters from users. For copies write American Colloid Company, 363 W. Superior St., Chicago.

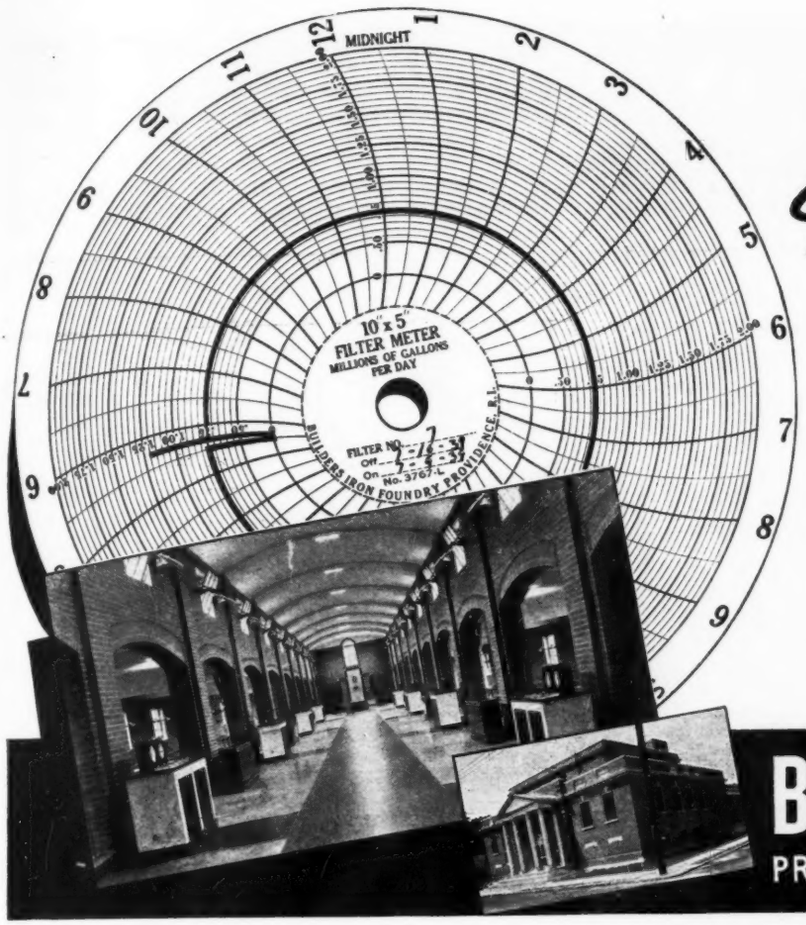
"Helical Speed Reducers"—of many models and providing fifteen variations of standard speed reduction (in ratios of from 40 to 1 up to 250 to 0), are presented in a new 16-page bulletin from W. A. Jones Foundry and Machine Co. of Chicago. This type of worm-helical reducer was developed especially for vertical shaft driven operations such as mixing tanks and flocculators, requiring large reductions in speed. Diagrams picturing general assembly, dimensional drawings with tabulated reduction ratios and corresponding horse-power capacities, and torque charts, occupy several pages. Amongst the typical installations pictured are some familiar in the water and sewage fields. For a copy of Bulletin 75 write W. A. Jones Foundry & Machine Co., 4401 Roosevelt Road, Chicago, Ill.

"ANNITE CLEANSER" (for all purposes) is described in a folder from Quigley Company of New York. This detergent contains no harsh alkali or abrasive and the purveyor claims that it will not injure any fabric or surface not affected by plain water. The basis of its effectiveness is its power to emulsify greases and it is claimed that "Annite" (1 oz. to the gallon of water) does three or more times as much cleaning work as ordinary cleansing compounds do. For further details write Quigley Co., 56 West 45th St., New York City.

"Cochrane Appliances" (for water treatment and power plants) are cataloged in an indexed quick-reference piece from Cochrane of Philadelphia. Amongst the items of especial interest to readers of this magazine are the well-known orifice type Cochrane Electric Flow Meters, so long used in industrial and power plants; Pressure Regulating and Back Pressure Valves; Boiler Blow Off Valves; Steam Condensate Traps; Heat Exchangers; Softeners (Hot and Cold Process and Zeolite Types); Deaerators. In this Cochrane "information condenser," bulletins covering the various items are noted in this. For a copy of Cochrane's Equipment Guide or bulletins offered, specifically covering any of the above items, write Cochrane Corporation, Philadelphia, Pa.

"Worthington Deaerators" are the subject of a recent bulletin from Worthington, which describes these units widely used in the important step of deoxygenating boiler feed return and make up water. Cut-away illustrations picture the system of splash aeration in partial vacuum, and the various automatic control devices. For Bulletin W.-210-B 24, write Worthington Pump and Machinery Corp., Harrison, N. J.

"Belting Biographies" is a 36-page booklet from U. S. Rubber Co., decribing the company's complete line of transmission and conveyor belts. The booklet represents a novel and interesting method of cataloging the company's belting products, in that instead of merely cataloging the various belts in conventional style, it presents case histories, dramatically illustrated. These depict installations, large and small. In addition it contains much technical information, including data on the selection of the proper belt, installation, speed of operation, pulley size, tension, carrying capacity, etc., plus suggestions for improving belting methods. For a copy of "Belting Biographies" write U. S. Rubber Co., Mechanical Goods Div., New York. N. Y.



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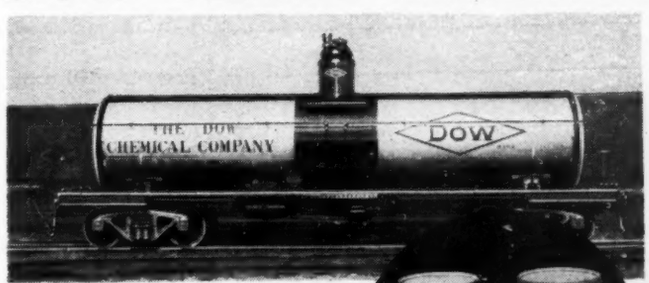

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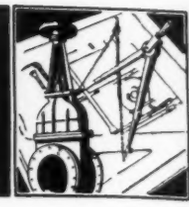

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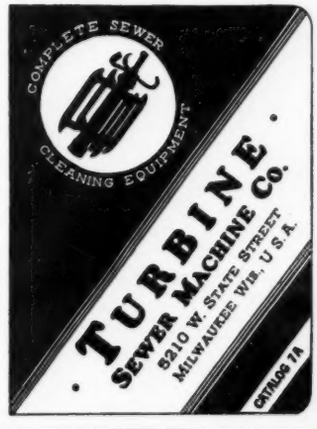

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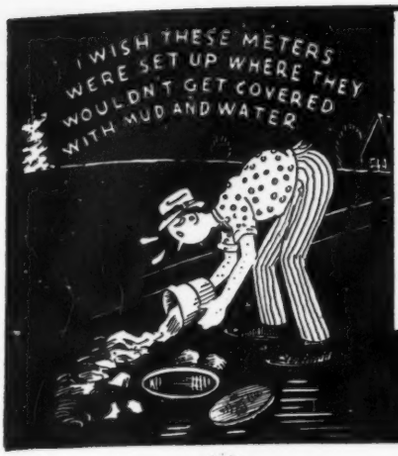

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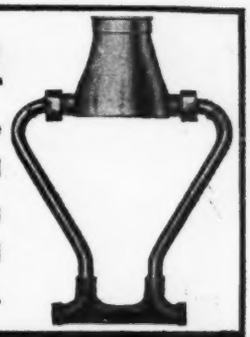

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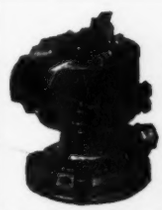

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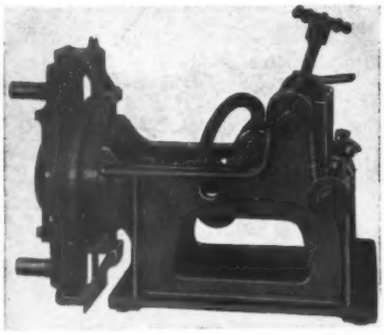

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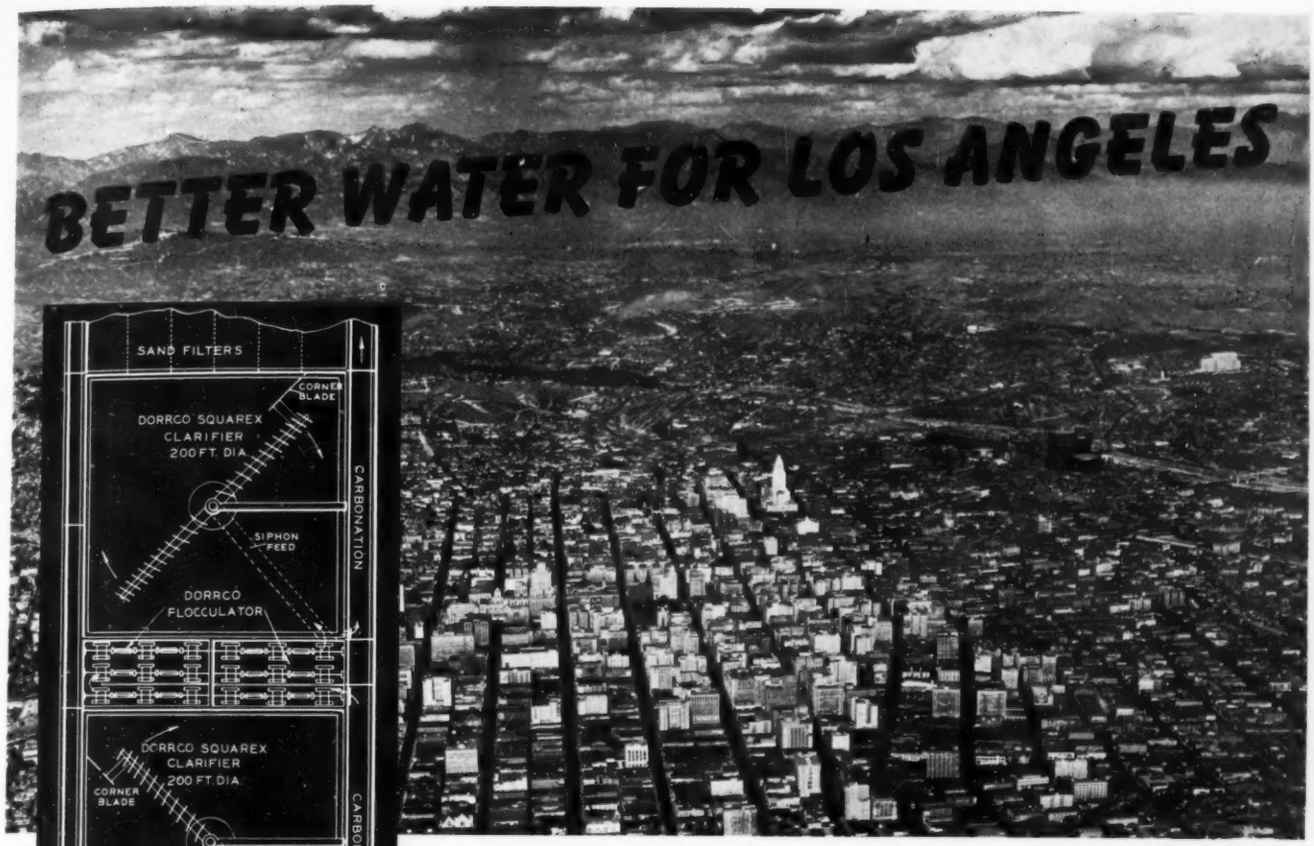

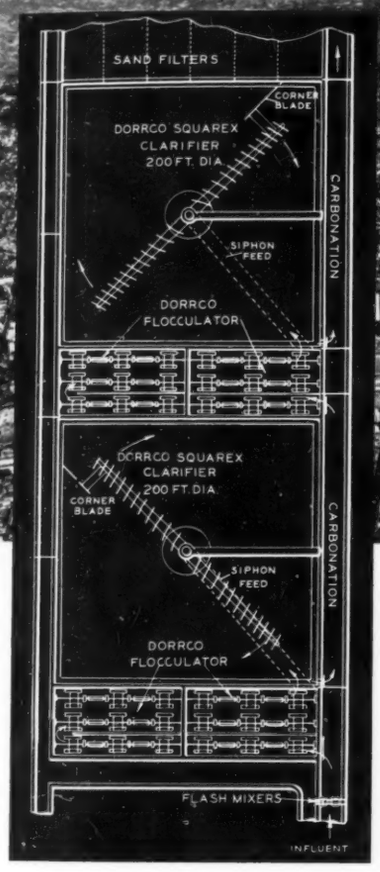

Fairchild Aerial Photo

treated in DORRCO SQUAREX CLARIFIERS *and* FLOCCULATORS

Southern California is to have another large water plant next year—this time a 100 M.G.D. water softening plant for the Metropolitan District of Los Angeles. The site is in the background of the above aerial view, half way between the coast and the San Bernardino Mountains.

This modern plant will be fully mechanized and Dorr-equipped throughout. Two, three-row Dorrco Flocculators, each 200 ft. long. Two big Dorrco Squarex Clarifiers, each installed in a 200 ft. square tank. Two multiple impeller Dorrco Flash Mixers for the diffusion of chemical reagents.

The sketch of the mixing, flocculation and sedimentation layout shows an ideal, economical arrangement in a single, compact structure. Note the efficient use of common dividing walls. Note the transfer of flocculated water to the clarifier via a siphon, to prevent the destruction of floc structure while in transit.

Raw water will be drawn from the Colorado River to the plant site at San Dimas through a recently completed aqueduct 252 miles in length. The consulting engineers are Hoover & Montgomery of Columbus, Ohio.

"Sedimentation," a new 38 page treatise on Dorr Clarifiers, including the Squarex, will be sent post haste, on request.

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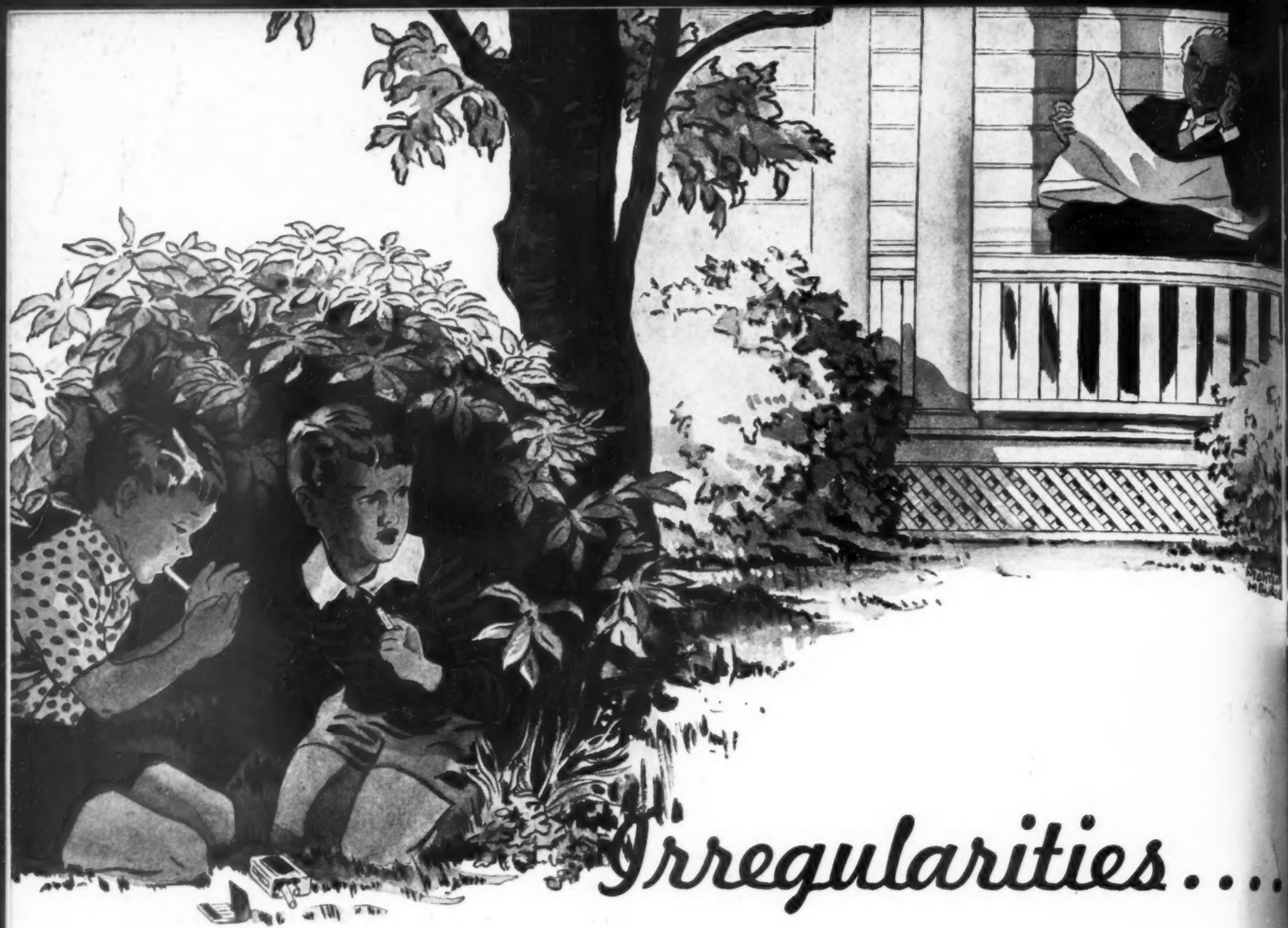

Irregularities....

must be seen before they can be corrected

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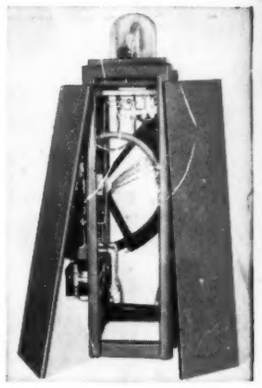

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